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CIVIL ENGINEERING, THE ARTS AND MANUFACTURES,

AND THE RECORDING OF

AMERICAN AND OTHER PATENTED INVENTIONS.

MAY, 1836.

Practical and Theoretical Mechanics.

Report of Experiments made by the Committee of the Franklin Institute of Pennsylvania, on the Explosions of Steam-Boilers, at the request of the Treasury Department of the United States.

(*Continued from page* 233.)

XII. On the elastic force of steam at working pressures.

The committee, determined to put the apparatus which was necessary for other experiments, to the best use possible, in determining the elastic force of steam at different temperatures; and accordingly great pains were bestowed upon the graduation of the gauge, the regulation of the temperature of its parts, &c., the comparison of the thermometers, the maintenance of the scales at about the same temperature, &c.* The small size of the boiler, and the various openings required to be made in it for the experiments which were the immediate objects of the committee, were unfavourable to the attainment of considerable pressures, but the discrepancies, even at working pressures, of the different tables of the elastic force of steam, made it important to push those trials as far as could be done without material changes. They succeeded without much difficulty in reaching ten atmospheres, which is but one atmosphere less than the reputed working pressure of our high pressure engines, and as the experiments on the safety valves have rendered probable, is very near the true working pressure.

* See description of apparatus, &c., pp. 2, 3, 4, &c.

A series of results obtained in the trials of the fusible plates, is given below in the tabular form.

The table contains the temperature observed by the thermometer in the water, corrected for the error of the graduation; the temperature of the scale of the thermometer, with a view to show, that it was not allowed to vary too considerably; the observed height of the mercury in the gauge, reduced to its mean height; the temperature of the air in the gauge; its volume at the observed temperature; the volume reduced to 48°, the temperature of graduation of the gauge at which the column of mercury, equivalent to an atmosphere, is very nearly 30 inches; the elasticity of the compressed air, in inches of mercury; the correction in the height of the column of mercury, for the depression produced in the cistern below; the height thus corrected; the height after subtracting the sensibly constant number for the column of water between the level of the steam pipe from the boiler and the cistern of the gauge; the total elasticity in inches of mercury; the elasticity in atmospheres. The first number in the table is merely introduced for the convenience of presenting certain data required for subsequent calculation, it gives the height of the mercury in the gauge before beginning the observations, after correcting for the height of the barometer.

TABLE No. I. *Of the Elastic Force of Steam at different Temperatures.*

Temperature of Steam.	Temperature of scale of ther.	Height of air gauge.	Temperature of air in gauge.	Vol. of air at observed temp.	Vol. of air at 48° Fah.	Elasticity of air in inches of mercury.	.01 height of gauge.	Height + .01 height.	Height + .01 height — 1.20 inches.	Total elasticity in inches of mercury.	Elastic force in atmospheres of 30 inches.
Fah.°	Fah.°	Inches.	Fah.°	Vols.	Vols.	Inches.	Inches.	Inches.	Inches.	Inches.	Atmos
		3.99*	62	8.33	8.101	27.26	.04	4.03	2.74	30.00	1.00
262¼	63	15.04	74	3.93	3.737	59.09	.15	15.19	13.90	72.99	2.43
268½	71	16.34	,,	3.43	3.259	67.76	.16	16.50	15.21	82.97	2.76
275½	,,	17.34	,,	3.05	2.898	76.20	.17	17.51	16.22	92.42	3.08
286½	,,	18.94	,,	2.44	2.319	95.23	.19	19.13	17.84	113.07	3.77
296½	,,	19.94	,,	2.05	1.948	113.36	.20	20.14	18.85	132.21	4.41
298½	73	20.11	,,	1.99	1.891	116.76	.20	20.31	19.02	135.80	4.53‡
302	,,	20.44	,,	1.86	1.767	124.98	.20	20.64	19.35	144.33	4.81‡
305½	76	20.79	75	1.73	1.641	134.57	.21	21.00	19.71	154.28	5.14
313½	79	21.39	,,	1.50	1.422	157.30	.21	21.60	20.31	175.61	5.85§
317½	80	21.64	,,	1.405	1.332	165.79	.22	21.86	20.57	186.36	6.21
320½	,,	21.79	76	1.347	1.275	173.20	.22	22.01	20.72	193.92	6.46
327¾	,,	22.24	,,	1.176	1.113	198.41	.22	22.02	20.73	219.14	7.30
333¾	,,	22.69	,,	1.004	0.950	232.46	.23	22.92	21.63	254.09	8.47

* This observation shows the height of the gauge before the experiment, corrected for the height of the barometer.

† Mean of 4 observations. ‡ Mean of 2 observations. § Mean of 2 observations.

A curve traced to represent these observations, the ordinates representing the pressures, and the abscissæ the temperatures, is quite regular, until the temperature corresponding to eight atmospheres is attained, when it rises abruptly. This fact was explained by examining the gauge; it was found that the cement used in attaching the glass tube to its ferule had become softened and had permitted the tube to rise. This defect was remedied and its recurrence prevented. It was then determined to repeat the entire series of observations, and to

carry them as high as could be done, with reasonable convenience, aiming particularly, to embrace the range of working pressures of the American engines.

The results are contained in the following table, in which the observed data, and calculated numbers, are arranged as in the last table. This table extends to 9.91 atmospheres and to the temperature of 352° Fah.

Care was taken that the elasticities were increased not too rapidly, and the last numbers obtained, were verified by keeping the temperature sensibly constant for a considerable time.

TABLE No. II. *Of the Elastic Force of Steam at different Temperatures.*

Temperature of steam.	Temperature of thermometer scale.	Height of mercury in air gauge.	Temperature of air of gauge.	Volume of air at observed temperature.	Volume of air at 48° Fah.	Elasticity of air in inches of mercury.	.01 height of gauge.	Height + .01 height.	Height + .01 height — 1.20 inches.	Total elasticity in inches of mercury.	Elastic force in atmospheres of 30 inches.
Fah.°	Fah.°	Inches.	Fah.°	Vols.	Vols.	Inches	Inches.	Inches.	Inches.	Inches.	Atmos.
		5.56*	48	7.695	7.695	25.67	.06	5.84	4.55	30.00	1.00
248¼	54	14.04	53	4.32	4.277	46.19	.14	14.18	12 89	59.08	1.97
269½	—	17.34	52	3.05	3.026	65.29	.17	17.51	16.22	81.51	2.72
284½	—	19.64	,,	2.17	2 152	91.76	.19	19.83	18.54	110.30	3.68
289½	—	20.06	,,	1.99	1.974	100.05	.20	20.26	18 97	119.02	3.97
294½	—	20 56	53	1.82	1.802	109.63	.21	20.77	19.48	129.11	4.30
299½	—	21.04	54	1.63	1.611	122 66	.21	21 25	19.96	142.62	4.75
304½	—	21.34	54½	1.52	1.500	131.66	.21	21.55	20.26	151.92	5 06
310½	—	21.64	,,	1 405	1.382	142.94	.22	21 86	20.57	163.51	5.45
314½	58	22 04	55	1 25	1.233	160.26	.22	22.26	20.97	181 23	6.04
319½	—	22.34	55½	1.14	1.124	175.86	.22	22 56	21 27	197.13	6.57
329¾	—	22.84	56	0.95	0.937	210.84	.23	23 07	21.78	232.62	7.75
334½	66	22.94	57	0.92	0.904	218.60	.23	23 17	21.88	240 48	8.02
338¾	—	23.04	57½	0.887	0.870	226.92	.23	23.29	22.00	248.92	8.30
345	—	23 24	,,	0 82	0.805	245.44	.23	23.47	22.18	267.62	8 92
348	—	23.34	58	0.787	0.771	256.05	.33	23.57	22 28	278.33	9.28
350	—	23 44	,,	0.752	0.737	267.97	.23	23.67	22 38	290.35	9.6²
352	—	23.50	,,	0.733	0.719	274.92	.23	23.73	22.44	297.36	9 91
346	—	23.28	62	0.807	0 785	251.78	.23	23.51	22.22	274.00	9.13

* This observation shows the corrected height of the gauge before the experiments.

There is one observation, namely, that at 329¾°, which is certainly recorded erroneously; but omitting this one, the rest which are given, present a very tolerable regularity in the curve traced to represent them. For the sake of adding to the force of these results the scattered observations of temperatures and pressures incidentally made during the other experiments of the committee, are brought together in the annexed table.

A column is added to the table, to show the number of observations employed in obtaining the results.

TABLE No. III. *Of the Elastic Force of Steam at different Temperatures.*

Temperature of steam.	Temperature of thermometer scale.	Height of mercury in air gauge.	Temperature of air in gauge.	Volume of air at observed temperature.	Volume of air at 48° Fah.	Elasticity of air in inches of mercury.	.01 height of gauge.	Height of gauge + .01 height.	Height + .01 height — 1.29 inches.	Elasticity of steam in inches of mercury.	Elastic force in atmospheres.	No. of observations.
Fah.°	Fah.°	Inches.	Fah.°	Vols.	Vols.	Inches.	Inch	Inches.	Inches.	Inches.	Atmos.	
		3.91*	59	8.35	8.169	27.34	.04	3.95	2.66	30.00	1.00	
234	54	8.80	55	6.39	6.301	35.45	.09	8.89	7.60	43.05	1.43	1
239¼	62	9.94	61	5.94	5.788	38.59	.10	10.04	8.75	47.34	1.58	3
245¼	68	11.16	63	5.46	5.300	42.14	.11	11.27	9.98	52.12	1.74	5
250¼	70	12.54	63	4.92	4.776	46.77	.12	12.66	11.37	58.14	1.94	4
256¼	73	13.88	64	4.38	4.243	52.64	.14	14.02	12.73	65.37	2.18	5
262⅔	77	15.14	64	3.89	3.768	59.27	.15	15.29	14.00	73.27	2.44	2
271	70	16.34	65	3.43	3.316	67.35	.16	16.50	15.21	82.56	2.75	4
278	75	17.44	70	3.01	2.882	77.49	.17	17.61	16.32	93.81	3.13	3
288¼	75	18.74	68	2.50	2.403	92.94	.19	18.93	17.64	110.58	3.69	3
291	76	19.14	65	2.36	2.282	97.88	.19	19.33	18.04	115.92	3.86	2
292½	62	19.44	63	2.25	2.184	102.26	.19	19.63	18.34	120.60	4.02	3
300	73	20.12	65	1.98	1.914	117.33	.20	20.32	19.63	136.36	4.55	4
303½	74	20.54	66	1.82	1.756	127.27	.20	20.74	19.45	146.72	4.89	1

* This observation shows the corrected height of the gauge before the experiments.

This table enables us to go as low as 1.43 atmospheres, and is strikingly accordant with the two others as far as they extend in common.

A curve which would be traced by the following table, which may be considered to represent the mean of the foregoing, would differ little more than one-tenth of an atmosphere in any part of the range, from the observations, omitting one noticed in the first, and another noticed in the second table; the pressures in general differing less than one-tenth of an atmosphere from the observed pressures.

TABLE *of the Elastic Force of Steam, from one to ten Atmospheres.*

Pressure.	Observed Temp.	Pressure.	Observed Temp.	Pressure.	Observed Temp.	Pressure.	Observed Temp.	Pressure.	Observed Temp.
Atmos.	Fah.°	Atmos.	Fah.°	Atmos.	Fah.°	Atmos.	Fah.°	Atmos.	Fah.°
1	212	3	275	5	304½	7	326	9	345
1½	235	3½	284	5½	310	7½	331	9½	349
2	250	4	291½	6	315½	8	336	10	352½
2½	264	4½	298½	6½	321	8½	340½		

To compare our results with those given by the committee of the French Academy, we have traced, on Plate 5, a curve, from the above table, and another from those of the thirty observations, selected by the committee of the Academy, from their experiments, below ten atmospheres. The curve

of our observations, passes at low pressures nearer to the line AB than that of the French experimenters, and after coinciding at the medium pressures of the table, crosses the latter, differing at ten atmospheres 5 degrees, or at 352½ degrees .65 of an atmosphere. The curve of our observations is traced in a full line, that of the French Academy is dotted.

The difference here noticed is too considerable to be admitted, as within the limits of errors in the apparatus or in observation. Having an authority of so much weight against them, the committee have been driven to examine their results very closely. The care employed in the graduation of the gauge seems to exclude the idea of error from it; the upper portion of the scale was divided to .05 of an inch, and could easily be read to half of that distance, making about .1 of an atmosphere at the highest pressure attained. A specific correction for capillarity was ascertained and employed. In one point of manipulation, namely, the method employed to dry the air, the committee differed from what was usual, and though they think there is reason to confide in that method, they have examined what effect would be produced if the air were saturated with moisture. Recent experiments, on the passage of gases, out and into vessels placed over mercury, and observations connected with them, warrant, moreover, a suspicion that dry air standing in a glass vessel over mercury, the surface of which covered by water, may become impregnated with vapour. The effect of such a source of error they have calculated* in the highest and lowest results of table No. II. and find it to be as follows:

For 248¼° the tension of the vapour is 1.96 instead of 1.97, and
„ 352 „ 9.78 „ 9.91.

Differing from the numbers given in table No. II. by .01 and .13 of an atmosphere.

This supposition is thus shown to be inadequate to explain the discordance, and must, in fact, be deemed, to a certain extent, gratuitous.

The committee have next compared the results furnished by the safety-valves graduated independently of the gauge, and these, as has already been shown, gave calculated pressures four per cent. and ten per cent. higher than the pressures indicated by the gauge. From these independent experimental data we have then an evidence that our results are, probably, not too high.

* If v be the volume of moist air and v', that of the dry air corresponding to it, e the elasticity of the air when expanded by the moisture, and e' of the dry air equivalent in elastic force to the mixture, and t be the tension of the vapour in the air, then the volume of the air being increased by the presence of the moisture, and the elasticities being inversely as the volumes.

$$e : e' :: v' : v, \text{ whence } v' = \frac{e\,v}{e'}$$

$$\text{but, } e = e' - t, \text{ whence } v' = v - \frac{v\,t}{e'}$$

This equation is true at all pressures if we suppose the space originally to be saturated with moisture; for as the space becomes less, a portion of the vapour will be converted into water. The value for e' may be derived in any assumed case from Table II. page 78.

To apply these remarks. From the first line of Table No. II. we have

$$v = 7.695,\ e' = 25.67,$$

and from Mr. Dalton's experiments, t corresponding to 48°, is .35 of an inch.

$$\text{whence } v' = 7.695 - \frac{7.695 \times .35}{25.67}, \text{ or}$$

$$v' = 7.495$$

For 248¼°, Table No. II. gives $v = 4.32$, $e' = 46.19$, and the temperature 53°, whence $t = .41$ and $v' = 4.28$ at 53°, and the elastic force of the steam is 1.94 atmospheres.

In like manner for 352°, $v' = 0.732$ at 58° and the first result for v, that at 48°, which gives 7.495 volumes, makes the corresponding pressure 9.78. This number differs but .13 of an atmosphere from that in the table.

The question of the elastic force of steam has been examined by many experimenters, and with very various results. The committee propose to show the state of knowledge on the subject by comparing the principal series of experiments referring to temperatures above 212°, with their own, which are now under examination. In the first table, below, they have compared their results with those of Robison,* of Ure,† and of Taylor‡.

The first two experimenters named, used an open mercury gauge in their experiments, and the thermometers were exposed to the pressure of the steam. This latter circumstance would tend to render the observed temperature slightly too high, or the observed pressure, relatively to the temperature, too low, as far as it produced any effect.

Elastic Force of Steam in Atmospheres.

Temp. of steam in degrees Fah.	Committee of Franklin Institute.	Prof. Robison.	Difference.	Dr. Ure.	Difference.	Mr. Taylor.	Difference.
212°	1.00	1.00	.00	1.00	.00	1.00	.00
240	1 64	1.83	—.19	1.72	—.08		
250	2 00	2.23	—.23	2.06	—.06	1 97	+.03
260	2.35	2.68	—.33	2.41	—.06	2.34	+.01
270	2.74	3.14	—.40	2.88	—.14	2.75	—.01
280	3.25	3.53	—.28	3.40	—.15	3.26	—.01
290	3.89			4.00	—.11	3.82	+.07
300	4.60			4.66	—.06	4.46	+.14
310	5.50			5.38	+.12		
320	6.40					5.98	+.42

The experiments of Watt are not referred to, as he states himself, that he has doubts of their accuracy, and defers to the results of Mr. Southern, which will be given presently.

The results of the committee, as to pressure corresponding to temperature, all fall below those of Professor Robison, the extremes being .14 and .40 of an atmosphere, they approach nearer to those of Dr. Ure, differing in the extremes — .06 and + .12 of an atmosphere. They agree even more nearly with the experiments of Mr. Taylor, tending, generally, to gain upon them; thus at 260° the difference is .01 of an atmosphere, and at 320° is .42. The temperature corresponding to six atmospheres, in the table of the committee, is 315½°, to the same (5.98) in that of Mr. Taylor, 320°, and to the same in that of the French commission, 320.4, the latter two agreeing very closely.

In the following table are given a comparison of the experiments of the committee, with those of Mr. Southern,§ Professor Arzberger,‖ of Vienna, and the Commission of the Academy of Paris.¶ The pressures were obtained in the experiments of Mr. Southern, by a piston valve, which is stated to have been checked, in part, by a mercury gauge; in the experiments of Professor Arzberger by a spherical valve of steel; and in those of the French commission, by a closed gauge, containing air. The numbers for these last named re-

* Robison's Mech. Philos. vol. ii.
† Phil. Trans. 1818.
‡ Phil. Mag. vol. ix.
§ Robison's Mech. Philos. vol. ii.
‖ Tredgold on Steam Engine, quoted from Bull. Sc. Tech. vol. i.
¶ Annales de Chim. et de Phys. vol. 43.

sults are those deduced from the empyrical formula adopted as representing, most closely, the experiments.

Pressures in atmospheres.	Temperatures.						
	By experiments of Com. of Frank. Inst.	By Mr. Southern.	Difference.	By Prof. Arzberger.	Difference.	By Commission of French Academy.	Difference.
	Fah.°	Fah.°	Fah.°	Fah.°	Fah.°	Fah.°	Fah.°
1	212						
2	250	250.3	—0.3	249*	+1.0	250.5	—0.5
3	275			274†	+1.0	275.2	—0.2
4	291½	293.4	+1.9			293.7	—2.2
5	304½					308.8	—4.3
5.87	314¼			322	—7.7	318 8	—4.5
6	315½					320.4	—4.9
7	326					331.7	—5.7
8	336	343.6	—5.6			342.0	—6.0
9	345					350.8	—5.8
10	352½					358.9	—6.4
10.83				372		362.8	

* 1.97 atmospheres. † 2.96 atmospheres.

From these comparisons it appears that for given temperatures the pressures determined by the committee, are lower than those found by Professor Robison, between 1 and 3½ atmospheres; lower than those of Dr. Ure, from 1 to 5½ atmospheres, except at the highest pressure, differing, however, but little from them; nearly the same from 1 to 2¾ atmospheres with those of Mr. Taylor, and higher from 2¾ to 6 atmospheres; higher than those of Mr. Southern; much higher than those of Professor Arzberger; higher than those of the French Commission.

The temperature given by the committee for the pressure of 8 atmospheres differs about 3° from that inferred from the temperature given by Christian* for 7.8 atmospheres; viz. 337° Fah.

The empyrical formula, adopted by the committee of the French Academy, as representing the law of relation between the pressure and temperature of steam, is of the form.

$$e = (a + nt)^5$$

Where e represents the elastic force of the steam, t the temperature, and a and n are constants, determined as well as the index, 5, from observation.

Tredgold had previously adopted a formula similar to this, in form, as agreeing nearly with the best experiments, to which he had access, and which have already been compared with the results obtained by this committee. Of this formula the French Commission remark, that the numbers which it gives, accord at the lower temperatures of their series, better with their experiments than those furnished by their own formula. Besides the differences in the numerical coefficents between the two formulæ now in question, Tredgold's formula has the number six instead of five for an index. In other words

* Quoted by Mr. Ivory, from Mech. Indust. vol. ii.

the elasticity increases more rapidly with the temperature than would be shown by the formula written on the preceding page.

With this law the experiments of the committee coincide; the index six applying much more nearly to their results than five. The empyrical formula adopted to represent their results is

$$e = (.00333\ t + 1)^6$$

where e is the elasticity of the steam in atmospheres, and t the excess of temperature above the boiling point of water in degrees of Fahrenheit's scale.

This formula will be found to accord very well at the higher pressures with the experiments of this committee, and its variations from them at other pressures to be sometimes in excess, and at others in defect.

This will appear by calculating the values of t* for the different pressures recorded in the table of the committee, on page 292, and comparing them with the numbers found by experiment.

Comparison of Temperatures calculated by the Formula, with those deduced from Experiment.

Elastic force.	Calculated temp.	Temp. by exper.	Difference.	Elastic force.	Calculated temp.	Temp. by exper.	Difference.
Atmos.	Fah.°	Fah.°	Fah.°	Atmos.	Fah.°	Fah.°	Fah.°
1	212.0	212	0.0	6	316.5	315½	+1.0
2	248.8	250	—1.2	7	327.3	326	+1.3
3	272.3	275	—2.7	8	336.4	336	+0.4
4	290.1	291½	—1.4	9	344.8	345	—0.2
5	304.4	304½	—0.1	10	352.5	352½	0.0

The comparison indicates that at the lower temperatures, the elasticity, as shown by the formula increases too rapidly, but from four up to ten atmospheres, the differences between the calculated and mean temperatures are less than one degree and a half of Fahrenheit's scale. The differences have sometimes the positive and sometimes the negative sign, which is favourable to the correctness of the formula as representing the law of increase of elasticity, in terms of the temperature.

In conclusion, it seems to the committee, that while the differences in the results of experimenters are greater than the present state of experimental science warrants, yet at pressures even exceeding ordinary working pressures, the relation of the temperature and pressure of steam may be considered, in a practical point of view, as sufficiently determined.

* The formula gives, $t = \frac{e^{\frac{1}{6}} - 1.}{.00333}$, or

$$\text{Log. } t = \text{Log. } (e^{\frac{1}{6}} - 1) - \text{Log. } .00333.$$

Presented to the Board of Managers of the Franklin Institute of the State of Pennsylvania, for the Promotion of the Mechanic Arts, and approved.

ISAAC HAYS,
Chairman Board of Managers.

ATTEST,
WILLIAM HAMILTON, *Actuary.*
Philadelphia, January, 1836.

We append to the foregoing report of the Committee on Explosions, a document which appears in the authorized copy of the report as a preface, and which contains an account of the transactions of the Committee. COM. PUB.

PREFACE.

The Committee, whose report of experiments, made by the request of the Secretary of the Treasury of the United States, is presented in the following pages, was appointed on the 10th of June, 1830, for the purposes expressed in the annexed resolution of the Board of Managers of the Franklin Institute, of the State of Pennsylvania, for the promotion of the Mechanic Arts.

"*Resolved*, That a committee of seventeen members be appointed, to examine into the causes of the explosions of the boilers used on board of steam-boats, and to devise the most effectual means of preventing the accidents, or of diminishing the extent of their injurious effects."*

The Committee consisted of the following named members of the Institute.

Alex. D. Bache, *Chairman.*

Robert Hare, M. D.	J. K. Mitchell, M. D.
S. V. Merrick,	Benjamin Reeves,
W. H. Keating,	George Fox,
Isaiah Lukens,	Thomas P. Jones, M. D.
James J. Rush,	W. R. Johnson,
James Ronaldson,	M. W. Baldwin,
Frederick Graff,	James P. Espy,
R. M. Patterson, M. D.	George Merrick.

Immediately after their appointment, the Committee addressed a circular letter to persons, whom they supposed would be able to give information, in regard to the explosions of steam-boilers which had occurred in our country, or abroad, and of which no accounts had been previously published. They took, also, other means to inform themselves on the subject referred to them.

The information derived from replies to the circular has already been made public.†

While the Committee were engaged in the inquiries necessary to enable them to report to the Managers of the Franklin Institute, a letter was received by that body from the Secretary of the Treasury of the United States, informing them that funds had been placed, by the House of Representatives, at the disposal of the department, for inquiries in regard to the explosions of steam-boilers, and inviting experiments on the subject, by the Institute, at the expense of the Treasury Department.

A series of questions, connected with the probable causes of explosion, or with theories which have been offered in relation to them, and with the safety of the steam engine, was submitted to the Secretary of the Treasury, with a plan of experiment based upon the queries, and an estimate of the cost of the experiments. This plan was approved, and authority given to add to the original subjects proposed for investigation, any others which might suggest themselves in the course of the experiments; the amount to be expended being, however, limited.

* This resolution was moved by W. H. Keating, Esq., who subsequently declined the chair of the Committee, and Prof. A. D. Bache was chosen chairman

† Journal Franklin Institute, vols. viii., ix., and x.

In order to carry on the experiments, the following sub-committees were appointed.

1. On the experiments,* excepting those relating to the strength of iron and copper.

Messrs. A. D. Bache, M. W. Baldwin,
Benjamin Reeves, S. V. Merrick,
W. H. Keating, Isaiah Lukens.

2. On the strength of iron and copper used for steam-boilers.†

Messrs. W. R. Johnson,
A. D. Bache,
Benjamin Reeves.

The first of these sub-committees presented the report of their experimental investigations, which, having been examined by the Committee, was finally adopted on the 23d of December, 1835, and ordered to be submitted, through the Managers of the Institute, to the Secretary of the Treasury.

The labours of the second sub-committee, as well as a report on the subjects in relation to which the Committee was appointed, yet remains to be presented.

It was deemed proper to delay such a report, until all the light which the experiments could afford, had been shed upon the important and intricate subject referred to the Committee.

On behalf and by direction of the Committee, &c.

ALEX. DALLAS BACHE, *Chairman.*

FOR THE JOURNAL OF THE FRANKLIN INSTITUTE.

Account of the Explosion of the Boiler of the Steamboat Wm. Gibbons. By THOMAS EWBANK, of New York.‡

This explosion occurred on Thursday morning, January 21st, as the boat was entering this harbour, on her return from Charleston, (S. C.) By this melancholy disaster, six lives have been lost.

The Wm. Gibbons has but one boiler, made of wrought iron, and similar in its construction to those of the "Ohio," and "New England," but having a greater number of horizontal flues. These terminate, as in the boilers of those boats, in a large vertical flue, which passes through the roof of the boiler. It was this flue which was collapsed. The following memoranda were made by me on different visits to the boat.

January 24. I visited the Wm. Gibbons this day. The chimney proper, or smoke pipe, (represented by the dotted lines, *a*, *a*, in the annexed sketch, Plate 7, Fig. 1,) had been removed. Upon looking down, the collapse was quite obvious. The flue was pressed together, so as to be closed almost entirely at the part where the rent had taken place. A section of that part is represented at F. Fig. 2, exhibiting a three cusped

* This sub-committee had the subjects referred to them on the 1st of November, 1830.

† Appointed January 4th, 1831.

‡ This interesting account was addressed to the Committee on Explosions, in consequence of a request made to Mr. Ewbank by a member of that Committee. We feel persuaded that if intelligent men at the different places near which explosions occur, would take pains to ascertain the nature of the effects, and make public the results of their examinations, the cause of humanity would be essentially served. It will be seen that Mr. Allaire, the maker of the boiler of the Wm. Gibbons, has set a most praiseworthy example, by affording every facility for examining the effects of the explosion.

COM. PUB.

figure, instead of that of a circle, its original form. As the flue was still enclosed in the case B, the precise situation of the rent with respect to the surface of the water in the boiler, could not then be accurately ascertained without entering the boiler. The collapsed flue is made of quarter inch iron, and is three feet in diameter. A space of seven inches is left between it and B. The steam pipe, S, is connected to the latter at its upper end, which is eight feet above the roof of the boiler.

January 26. This day B was removed, leaving the ruptured and vertical flue, C in the sketch, fully exposed to view. The rent, R, was four inches above the roof of the boiler. It was in one of the horizontal seams, and confined almost wholly to it; it extended nearly three feet, or about one-third of the circumference. The line of separation was through the centre of the rivet holes, nearly the whole extent, a strip of metal thus separated being left in its place, in the lower portion of the flue. The iron is cracked in some places, where the flexure has been greatest, as at O.

Through the politeness of James P. Allaire, Esq., the builder of the engine and boiler, and also one of the owners of the boat, I have obtained a portion of the ruptured flue, which is sent with this communication. It is from one end of the rent. The thickness of the metal at the part ruptured is not sensibly diminished, as will be perceived by the specimen sent. The question of the deterioration of the metal by heat, may perhaps be determined by it also.

The original cause of this explosion is conceived to be identical with that of the Ohio,* and is to be found in the "construction of the boiler," the arrangement of the flues in it being such that the principal one, (that which collapsed,) could not be protected by the water. Its exposure to high degrees of temperature, under these circumstances, must necessarily diminish its strength very materially. The increase of its temperature is also accompanied with an increased elasticity of the steam; hence its power of resisting the pressure around it diminishes as that power is augmented.

In addition to the remarks made on these flues in the case of the Ohio, it may be further observed, that, from their greater dimensions compared with the horizontal ones, their strength necessarily bears no comparison with that of the latter, even if covered, like them, with water. How much more liable to destruction, then, are they, wholly unprotected by it? The horizontal flues of the Wm. Gibbons do not exceed twelve inches in diameter; the ruptured flue, as before observed, is thirty-six inches.

If steam chimnies are deemed indispensable, would it not be safer to convey each horizontal flue separately through the roof of the boiler, than to combine them all in the large one in question?

The surest remedy, however, is to make all interior flues terminate outside of the boiler, *below* the water line. Neither this explosion, nor that of the Ohio, could have occurred, if such had been the arrangement in their respective boilers.

The immediate cause of the explosion is attributed, and no doubt justly, to the imprudence of the second engineer, and two of the firemen,† in wantonly urging the fire with quantities of wood, (anthracite coal being the principal fuel used,) and thus unnecessarily, at that time, increasing the force of the steam, and the heat of the vertical flue,

* See this Journal, vol. x., p. 226, Ewbank on the Explosion of the Steamboat Ohio. The effects on the boiler, in that case and this, are strikingly similar. Com. Pub.

† They were all killed.

against the positive and repeated directions of the chief engineer, who was very unwell at the time. It appears that one or more of them ridiculed the apprehensions of that officer, while in this act of disobeying his orders. His reasons for giving such directions are not left to conjecture, when we learn that, off Cape Hatteras, he had discovered that the vertical flue was pressed inwards, in one place, although but slightly. This is the fact referred to by one of the passengers, (Mr. Newmark,) in the statement which follows. The *repairs* done to the boiler, near Cape Hatteras, were in consequence of a leak near one of the fire doors.

The engine and boiler were considered in good repair; there was no design to repair either previous to the next trip, as has been stated in some of the papers. The only alterations contemplated were in the paddles, which they are now undergoing.

The following statement of a number of the passengers who were on board of the William Gibbons, was published just subsequent to the explosion.

To the Public.

The undersigned, passengers on board the steam packet Wm. Gibbons, on the occasion of her late disastrous trip from Charleston to this port, convinced that no adequate account has yet been given to the public of the circumstances connected with the explosion, by which six unfortunate individuals were hurried away in all the vigour of life, feel it to be their duty to submit to the community a concise statement of certain facts within their personal knowledge. Events so calamitous, however great the individual anguish of which they are the occasion, may, nevertheless, be the source of some public good; but this good can spring only from a developement of all their attendant circumstances, to such an extent that they may constitute a warning and a lesson for the future.

The Gibbons left Charleston on the morning of Sunday, the 17th of January, at 10 o'clock. On Monday, about sunset, she passed Cape Hatteras. Not long afterward, the engine was stopped, the fires extinguished, and the water discharged from the boiler. The whole night was consumed in repairs, with the precise nature of which we were, at the time, unacquainted. The inquiries of the passengers failed to elicit any satisfactory information; there seemed, indeed, to exist a studied determination, on the part of those in authority on board, to avoid making any disclosures.

After this time we carried very low steam, the gauge rod not standing generally higher than seven, eight, or nine inches. Before reaching Cape Hatteras, it had stood usually at fifteen, sixteen, or eighteen. Being in plain sight, it was frequently noticed, for many of the passengers were suspicious of our danger, and mentioned their apprehensions repeatedly.

On Thursday morning, it was remarked that we were again carrying heavy steam, a circumstance which had not been before observed since the occurrence at Cape Hatteras. A gentleman who was standing near the steam chimney, for the purpose of warming himself, called the attention of another to the fact that the rod stood at fifteen inches. This was mentioned to several, who observed that our speed indicated high pressure. These gentlemen believe that not more than ten or fifteen minutes had elapsed after this observation, before the explosion took place. In order, however, to be perfectly safe, they are willing to testify that the time was not greater than half an hour; our speed, meanwhile, by no means indicating a diminished power. Let this be compared with the statement which has been given to the public, that, at the moment of the accident, the rod stood at

nine inches. At the *very* moment of the accident, what was the pressure, Heaven only knows; but that an explosion could have taken place from the expansive force of steam at a pressure of nine inches, in less than half an hour after a pressure of fifteen had been endured without accident, is a supposition not remarkably plausible.

On the morning of Thursday, the day of the accident, between one and two o'clock, the first engineer was heard to caution his assistant, to whom at that hour he committed the charge of the engine, against getting up the steam too high, making use of the expression, "she will not bear (or carry) much steam." An unusual sound was soon after heard, described by a passenger as resembling the wheezing of a wind-broken horse, which was believed to be occasioned by the escape of steam through an irregular channel. After daylight another sound was noticed, like what might be occasioned by the dripping of water upon coals. It may be inquired whether this sound did not attract the attention of the captain himself, when in the forward cabin, between seven and eight o'clock in the morning, and whether he did not then approach the end of the boiler to ascertain the cause.

The undersigned choose not to allude to matters of common belief in the community, but to which their personal knowledge does not extend. They are persuaded, however, that a judicial investigation would demonstrate that the boiler of the Wm. Gibbons had been deemed unsafe antecedently to this last unfortunate trip, and the accident we have now to deplore, was not the first intimation of its insecurity received by the owners. If it be true that the Gibbons was not intended for another trip before receiving repairs, the fact ought to be known. This boat was sent out in the room of the Columbia, which had been advertised at the other end of the line, but was not despatched, in consequence, it is said, of the incompleteness of her preparations.

The object of the undersigned is not to inculpate any one; if blame is any where due, the public, in view of the circumstances, will apply it to the right quarter. If no one is blameable, the facts will show this likewise: and the statement now made, being truth, and nothing but the truth, will acquit of groundless suspicion all who might otherwise suffer.

In cases like the present, where human life is endangered, or destroyed, too much light cannot be thrown upon the causes; too great watchfulness cannot be exercised to vindicate those, through whose instrumentality, though it be indirect, though it be but an error of omission, or of carelessness, the happiness of families is thus broken up, and the hearts of parents, of sisters, and of relations yet more near, are wrung with anguish.

It was not the original intention of the undersigned to make any public statement on this subject. The imperfect statements which have appeared in regard to it, have, however, induced them to the present course. The passengers of the Gibbons are now, in a great measure, dispersed. The names which follow, are those of all whom it has been found practicable to see.

Frederick A. P. Barnard,	New York.
James M'Dowall,	Augusta, Ga.
C. B. Seymour,	Roanoke, Ga.
Samuel K. Tallmadge,	Augusta, Ga.
O. E. Carmichael,	" "
Robert D. Hamlim,	" "

D. B. Nafew,	New York.
William Swift,	"
John F. M'Kinne,	"
Robert Cochrane,	"
Isaac Sniffen,	"
Charles Elms,	Charleston, S. C.
Joseph Newmark,	84 Murray street, New York.
E. Robbins,	New York.

The following fact, in addition to the above, may be stated by the subscriber. On Monday afternoon, before the occurrence at Cape Hatteras, I observed one of the engineers to open the sheet-iron door looking into the steam chimney, and afterwards to go down, and return in company with the other. After examining it together, one remarked to the other, "I think there will be no danger till we get to New York." This fact I stated to the coroner's jury on the body of Mr. Davega, in the presence of the captain and first engineer.

JOSEPH NEWMARK,
84 Murray street.

It is but fair to state, before concluding these remarks, the alleged advantages of steam chimnies. The following experiment is furnished by Mr. Allaire, as a case in point. His extensive experience, and long practice, together with the great facilities he possesses in his establishment for experimenting on a large scale, entitle his views to more than ordinary consideration.

A common boiler was found to generate steam so very slowly as to be almost useless; it was with difficulty that the steam could be maintained in it at seven pounds to the inch. A steam chimney was afterwards adapted to it, when the steam was with less trouble kept up to fifteen pounds.

It is said that there is no danger in steam chimnies, provided the steam is permitted to escape through the safety valve, which is placed on the steam pipe, *whenever the engine is not in motion*, as when the boat is in the dock, previous to starting, &c. The object of this is, to prevent the vertical flue above the surface of the water becoming unduly heated, for the steam, by passing up round it, carries off the caloric from its surface, and thereby tends to keep its temperature at the same range as that of the steam, or nearly so. The great source of the destruction of these flues, is said to be the neglect of this precaution. Some have been destroyed in a few weeks from this cause, while others have lasted for years. To prevent, however, their destruction, in future, from this source, Mr. Allaire is now lining them with fire-brick, which, it is supposed, will combine their peculiar advantages with perfect safety.

FOR THE JOURNAL OF THE FRANKLIN INSTITUTE.

Plan for a new Pump for Feeding Steam Engine Boilers, &c. By CHARLES POTTS, Civil Engineer.

Having had occasion, some years ago, to construct a small steam engine, with a view to make a few experiments in dynamics, and being desirous to make all the parts of my engine in the most simple and easy manner, having the least quantity of work about them, I fell upon the following plans for introducing water into the boiler. As I believe there is something in this contrivance worthy the attention of the mechanician, and that it may, in many instances, be substituted with advantage for the ordinary pump, I am desirous

of submitting it to the public, through the medium of your scientific journal. Before describing the plans, as exhibited in the drawing herewith presented, it may be well to premise, that the water intended to supply the boiler, is caused to flow therein by gravitation. Hence, it will be necessary, in all cases, that the water wherewith the boiler is to be fed, together with the apparatus herewith described for feeding, should be elevated above the level of the top water line of the boiler. Thus, in Fig. 3, Plate VII., C, D, represents the boiler of a steam engine, with the feeding apparatus, or pump, connected with it, and above it. In this figure, the feeding apparatus, or pump, in its general construction, very much resembles a common plug-cock. Fig. 4 exhibits another view of it; in both figures, the same letters of reference denote similar parts. A, B, is the plug, which is to be made *hollow*, as in Fig. 3, and to have its exterior surface turned true, and made to fit steam-tight into the shell, or casing, H, I. This casing is cast with two flanches upon it, one above, as *m*, *n*, and one below, as *s*, *t*; each flanch having an opening, *o*, *o*, through it. There is also an opening in the plug, as shown at *w*, Fig. 3.

During the operation of feeding, the plug, A, B, is caused to revolve around in its seat; this may be done by placing a pulley upon its axis, as shown at P, fig. 4, and strapping it from any convenient part of the engine. In order to show the operation of this machine more clearly, I have supposed a water tank, K, L, to be placed directly upon the upper flanch, with a pipe and ball cock from the *water pipes in the streets*, to supply it with cold water. The operation of this pump will be as follows: When the engine is put in motion, and, consequently, the plug, A, B, the opening, *w*, in the plug, will be brought round to the position shown in Fig. 3; in this position, the cold water from the tank above will *descend into the hollow or cavity* in the plug; but as the plug revolves, when the opening, *w*, has passed the opening in the upper flanch, the connection with the tank will be cut off; and when the opening, *w*, moves round, and comes over the opening in the lower flanch, the water from the plug will descend, and pass down the tube into the boiler, C, D. It will be obvious to the mechanician, that the quantity of water passed into the plug in one revolution, may be regulated in several ways, either by enlarging the opening into the plug, or by giving the plug a quicker, or slower, motion, at the time the openings are in juxtaposition.

To equalize the pressure above and below the water in the hollow of A, B, a small pipe, or channel, *x*, *y*, is made to the casing, H, I, whereby the steam passes up to the opening, *y*, in the casing; and when the opening, *w*, of the plug, is over the lower opening to the boiler, the small hole, *z*, will be in connection with the opening, *y*, so that the steam is then admitted into the top of the hollow of the plug, and the water in the plug will descend freely by the force of gravity. A similar opening may be contrived for the free admission of the water from the tank into the plug.

Having now described this pump, I shall make a few remarks in reference to what I conceive to be its advantages. And first: We have here an apparatus which will perform all the functions of a forcing pump, without valves. Secondly. The only resistance in the working of this pump, will arise from the friction of the exterior surface of the plug against the casing, as it revolves. And thirdly. It is a sure and certain regulator for the supply of water to the boiler. The first two items above mentioned are so obvious, that it were needless, perhaps, to comment upon them; the latter item, however, may not be quite so apparent. I will, therefore, show how the pump may serve

as a *regulator*. The feed-pipe, *u v*, must be connected with the boiler at the top water line, as E, E. Now, if the pump supplies water faster than it is evaporated, and the top water line, E, E, rises so as to cover the opening of the pipe, the pipe would be filled with water, instead of steam, and, consequently, the water in the plug, A, B, could not descend. When, however, the top water line, E, E, of the boiler, descended below the opening of the pipe, *w*, *v*, the pump would again operate to supply the boiler. In this manner, it would work so that, if properly adjusted in the first instance, the water in the boiler would always be continued at its proper height. It will be seen that, every time the pump, or plug, A, B, discharges its contents into the boiler, the chamber of the plug becomes filled with steam, and will be allowed to pass off and condense, when the opening of the plug connects with the tank. This process, it must be evident, will be an advantage, rather than otherwise, as much of the caloric of the steam will thus be imparted to the water, previous to its passing into the boiler. I have preferred describing the above apparatus, as it is the most simple in its construction, and, therefore, more easily to be understood. The same end, however, may be effected by a very different arrangement, as will be seen by reference to Fig. 5. Here, A, B, represents a *hollow plunger*, being turned smooth and true on its exterior surface, and made to work up and down through two stuffing boxes, E and F, placed on the ends of the hollow cylinder, or box, C, D. The plunger has three openings, *o*, *p*, *q*, (or it may be one long slit from *o* to *q*,) for the purpose of allowing the water to flow into and out of the chamber, C, D, through the hollow plunger; the small tube, or channel, *r*, *s*, is to allow the steam to enter at the top of the chamber, C, D, in order that the water may flow freely out from the chamber into the feed-pipe, *v*. If we suppose the water tank, K, L, Fig. 3, to be placed on the flanch, *t*, *u*, Fig. 3, and the plunger, A, B, to be connected with the engine, so as to be caused to move up and down, as the plunger of the ordinary forcing pump, it will be perceived that, when the plunger is up, the hole, *o*, will be within the tank, and the hole, *q*, within the chamber, C, D; hence, water from the tank may flow in and fill the chamber, C, D; and when the plunger is down, as is represented in the figure, the hole, *q*, will be open to the boiler, and the water in the chamber will descend, through *p* and *q*, into it. The relative diameters of the plunger, and that of the chamber, C, D, may be varied to suit the motion which is given to the plunger.

Philadelphia, February, 1836.

P. S.—I am aware that, in the practical operation of the above described pumps, some difficulties will probably occur, but I am fully persuaded that they are not insurmountable. Thus, for instance, when the pump is designed to regulate the quantity of water to the boiler, as it would be necessary to have the connection of the feed-pipe with the boiler near the top water line, the water from the boiler would frequently rise in the tube, and run up to the pump before the body of water in the boiler had risen to cover the opening of the feed-pipe. This difficulty would be remedied by a small tube from the top of the boiler, Fig. 3, to the opening, *y*, in the casing of the pump.

Fig. 4.

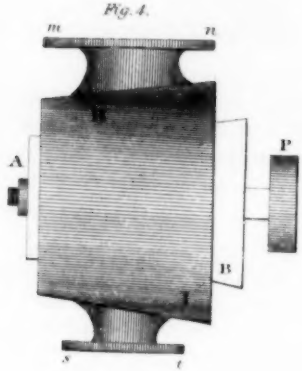
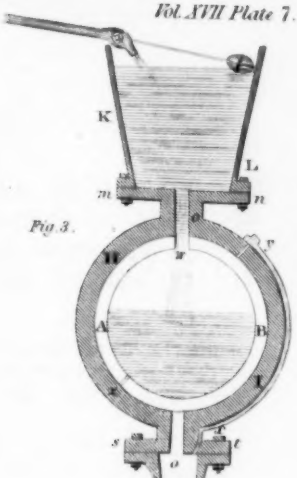
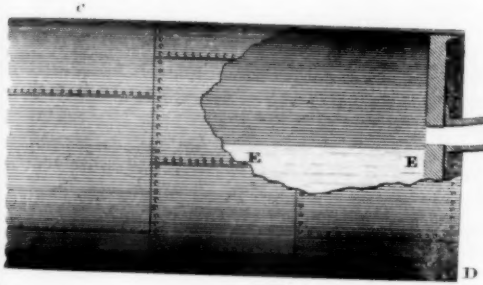


Fig. 3.





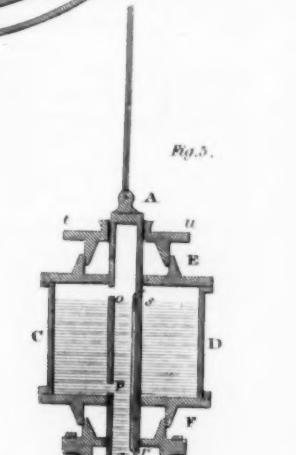
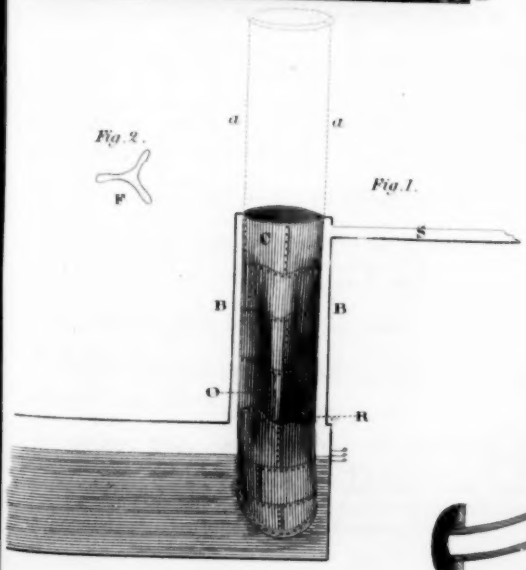


Fig. 5.

Fig. 2.

Fig. 1.



Physical Science.

Remarks on a Method, proposed by Doctor Thomson, for Determining the Proportions of Potassa and Soda in a Mixture of the two Alkalies, with the application of a similar investigation to a Different Method of Analysis. By A. D. Bache, Professor of Natural Philosophy and Chemistry, University of Pennsylvania.

In a recent number* of the "Records of General Science," Doctor Thomson gives the following method of determining the proportions of potassa and soda in a mixture of the two alkalies. The method is accompanied by an example of its use.

"1. Convert the mixture of potash and soda into sulphates, render these sulphates anhydrous by ignition in a platinum crucible, and determine their weight. Let it amount to 29 grains.

"2. Dissolve the two sulphates in water, and throw down the sulphuric acid by chloride of barium. Wash the sulphate of barytes obtained, dry it and weigh it after ignition. Let the weight be 43.5 grains, indicating 15† grains of sulphuric acid.

"3. Separate any excess of barytes that may have been added to the liquid, by the cautious addition of dilute sulphuric acid. Filter, evaporate to dryness and ignite. The salt thus obtained will consist of the mixture of potash and soda converted into chloride of potassium and sodium. Weigh this salt. Let the weight be 24.5 grains."

"Now the atom of potash is 6, and that of soda 4: and it is obvious from paragraphs 1 and 2 that the mixture of potash and soda will weigh 14."

"Let the [number of] atoms of potash in the mixture be x, and those of soda y, it is plain that we have:

$$6x + 4y = 14, \text{ and } x = \frac{14-4y}{6}$$

"By comparing paragraphs 2 and 3, it is obvious, that the weight of the chlorine in the 24.5 grains of the mixed chloride obtained is 13.5 grains. For it must be equivalent to the 15 grains of sulphuric acid. In this mixed chloride the potash is converted into potassium, and consequently its atom only weighs 5, while the atom of sodium weighs 3. We have therefore

$$5x + 3y + 13.5 = 24.5 \text{ and, } x = \frac{11-3y}{5}$$

If we equate these two values of x, we have

$$\frac{14-4y}{6} = \frac{11-3y}{5}$$

By solving this equation we obtain $y = 2$. From which we deduce $x = 1$.

Thus it appears, that in the supposed mixture there were 6 grains of potash and 8 grains of soda."

* January, 1836. On the Method of Determining the Proportions of Potash and Soda, when the two Alkalies are mixed together. By Thomas Thomson, M. D., F. R. S. L. and E., Regius Professor of Chemistry in the University of Glasgow.

† The equivalents of baryta and sulphuric acid are here assumed as 76 and 40 respectively, referring them to the hydrogen unit.

Now it seems to me that the third step in the analysis, namely that contained in paragraph 3, is unnecessary, all the numbers required for the calculation having been obtained by the first and second steps.

By the first step we obtain the weight of the mixed sulphates; by the second the amount of sulphuric acid present, whence results the weight of the mixed alkalies. But incidentally we have obtained the quantity of oxygen present in the mixed alkalies; for the chloride of barium and the sulphates of potassa and soda have by their reaction formed sulphate of baryta, and chlorides of potassium and sodium. And the oxygen of the baryta in the sulphate of baryta, is equal to the oxygen of the two alkalies. Subtracting this from the weights of the alkalies we have, without the necessity for the third step proposed by Doctor Thomson, the weights of the metals. These weights furnish his second equation.

In the example referred to, we have found by comparing paragraphs 1 and 2, the weight of the mixed alkalies to be 14, whence calling x and y the unknown number of equivalents of the potash and soda respectively, resulted the equation

$$6\,x + 4\,y = 14, \text{ and thence } x = \frac{14 - 4\,y}{6}$$

From the second paragraph the weight of sulphate of baryta obtained is given 43.5 grains; whence using the same equivalents as Doctor Thomson has employed, the baryta is found to be 28.5 grains, of which 25.5 grains is barium and 3 grains oxygen. Deducting this oxygen, which belonged to the alkalies, from the weight of the mixed alkalies, we have 11 grains for the weight of the metals, and the second equation given by Doctor Thomson.

$$5\,x + 3\,y = 11, \text{ or } x = \frac{11 - 3\,y}{5}$$

It is plain that these remarks will be true if the nitrate of baryta should be substituted for the chloride of barium in obtaining the quantity of sulphuric acid present; for the quantity of oxygen in the baryta of the precipitated sulphate, will always be equal to that in any protoxide, or protoxides, saturating the same weight of acid.

The third step in the proposed analysis is therefore superfluous, unless used as a means of verification.

I propose now to obtain, as Doctor Thomson has done, in the sequel of his paper, general equations for calculating the weights of the alkalies from the analysis, omitting only a reference to the third step, which has been shown to be unnecessary. As algebraic notation is repulsive to some who may chose to refer to this method of analysis, I will endeavour finally, to prove the results by arithmetical processes, and to point out a simple method of calculation.

It seems to me more convenient to determine the absolute weights of the alkalies from a formula, rather than the number of equivalents.

Let v be the weight of the potassa in the mixture; z that of the soda. Let m be the weight of the mixed sulphates obtained as stated in paragraph (1), and n the weight of the sulphate of baryta obtained as in paragraph (2), then using 76* as the weight of the equivalent of baryta, and 116 as that of sulphate of baryta, the baryta in n, will be $\frac{19}{29}\,n$; and the oxygen

* I have used throughout the equivalent numbers given by Doctor Thomson in the seventh edition of his System of Chemistry, in order to preserve uniformity in the results.

contained in this baryta will be $\frac{2}{29}\,n$. But the oxygen in v grains of potassa is $\frac{v}{6}$, and in z grains of soda is $\frac{z}{4}$, and since the oxygen in the alkalies is equal to that in the baryta,

$$\frac{v}{6}+\frac{z}{4}=\frac{2}{29}\,n, \text{ or } 58\,v+87\,z=24\,n. \ldots \text{(a.)}$$

Again, the sulphuric acid in n grains of sulphate of baryta is $\frac{10}{29}\,n$, therefore the alkalies in the mixed sulphates (1) will be $m-\frac{10}{29}\,n$; that is

$$v+z=m-\frac{10}{29}\,n=\frac{29\,m-10\,n}{29},$$

$$\text{or } 58\,v+58\,z=58\,m-20\,n. \ldots \text{(b.)}$$

combining this equation with (a,) we find $z=\frac{44\,n-58\,m}{29}$, and,

$$v=\frac{87\,m-54\,n}{29}.$$

These formulæ lead to the following rules, the analysis having been made as described.

1st. For the weight of the soda. From 44 times the weight of the sulphate of baryta (2), take 58 times the weight of the mixed alkaline sulphates (1) and divide the difference by 29.

2d. For the weight of the potassa. From 87 times the weight of the mixed sulphates (1) take 54 times the weight of the sulphate of baryta (2), and divide the difference by 29.

In the example referred to by Doctor Thomson, $m = 29$ and $n = 43.5$, whence,

$$z=\frac{44\times 43.5-58\times 29}{29}=\frac{1914}{29}-58=8; \text{ and } v=87-81=6 \text{ grains.}$$

The following arithmetical process may be substituted for the algebraic one.

Having found the weight of the mixed alkaline sulphates (1) and the sulphuric acid which they contain (2) the weight of the mixed alkalies is known.

The oxygen which these mixed alkalies contain is known, being equal to that of the baryta in the precipitate of sulphate of baryta (2), or $\frac{2}{29}$ths of the weight of that sulphate.

Potassa contains $\frac{1}{6}$th ($\frac{2}{12}$ths), and soda $\frac{1}{4}$th ($\frac{3}{12}$ths), of its weight of oxygen. The oxygen of the mixed alkalies, found as just stated above, is equivalent to $\frac{2}{12}$ths of the weight of the potassa, and $\frac{3}{12}$ths of the weight of the soda; that is to $\frac{2}{12}$ths, or $\frac{1}{6}$th of the weight of the mixed alkalies, together with $\frac{1}{12}$th of the weight of the soda. Therefore taking from the weight of the oxygen in the mixed alkalies, $\frac{1}{6}$th of the weight of the alkalies themselves, the remainder will be $\frac{1}{12}$th of the weight of the soda.

From which is deduced a very simple rule.

Find, from the steps of the analysis, the united weights of the alkalies, and the weight of the oxygen which they contain. Take $\frac{1}{6}$th of the former weight from the latter, and multiply the difference thus found, by twelve. The result will be the weight of the soda. Subtract this from the weight of the mixed alkalies, the remainder will be the potassa.

To apply this to the example in which the weight of the mixed sulphates is 29, and of the sulphate of baryta, equivalent to their acid, is 43.5 grains.

43.5 grains of sulphate of baryta contain 15 of sulphuric acid. The united weights of the alkalies is therefore 14; $\frac{1}{5}$th of which is $2\frac{1}{5}$. The oxygen of the baryta, in 43.5 grains of the sulphate of baryta, is 3 grains. Taking $2\frac{1}{5}$ from three we have $\frac{8}{5}$ds, which multiplied by 12 gives 8 grains for the weight of the soda. This taken from 14 leaves 6 grains for the weight of the potassa in the mixture.

At the suggestion of my friend, Professor H. D. Rogers, I am induced to extend the foregoing method of calculation to the usual way of determining the quantities of the alkalies by their conversion into the chlorides of their metallic bases, avoiding the ordinary step which requires their separation by the use of chloride of platinum, by determining the chlorine in the mixture, by nitrate of silver.

(A) The alkalies are to be converted into muriates, if not already in that state, by the ordinary steps of mineral analysis. These being evaporated to dryness, ignited and weighed, will give the amount of chlorides of potassium and sodium which are present.

(B) Dissolve the mixed chlorides in water acidulated with nitric acid. Nitrate of silver will throw down the chlorine, and by treating the precipitated chloride of silver in the usual way, the quantity of chlorine is deduced from the weight of the fused chloride.

To calculate the weights of the alkalies; let v and z represent the weights of the potassa and soda respectively; c the weight of the mixed chlorides (A), and d that of the chloride of silver (B). Using 146 as the equivalent of chloride of silver, d grains of the chloride contain $\frac{18}{73}$ d grains of chlorine; the weight of the metals in the mixed chlorides (A) is therefore $c - \frac{18}{73} d$. But v grains of potassa contain $\frac{5}{6} v$ of potassium, and z grains of soda, $\frac{3}{4} z$ of sodium. Whence $\frac{5}{6} v + \frac{3}{4} z = c - \frac{18}{73} d$.

The oxygen contained in the mixed alkalies is $\frac{8}{36}$ths, or $\frac{2}{9}$ths of the chlorine in the chlorides of their metallic bases, or is $\frac{2}{9}$ths of $\frac{18}{73} d$, or $\frac{4}{73} d$. And as v grains of potassa contain $\frac{1}{6} v$ grains of oxygen, and z grains of soda, $\frac{1}{4} z$ grains of oxygen, we have a second equation containing v and z; $\frac{1}{6} v + \frac{1}{4} z = \frac{4}{73} d$, or $\frac{5}{6} v + \frac{5}{4} z = \frac{20}{73} d$. Combining this with the equation obtained above, $z = \frac{76}{73} d - 2 c$, and $v = 3 c - \frac{90}{73} d$.

Whence result the following simple rules.

To obtain the soda from the method of analysis stated above, from $\frac{76}{73}$*rds of the weight of chloride of silver* (B), *take twice the weight of the mixed chlorides* (A).

To obtain the potassa. From three times the weight of the mixed chlorides (A), *take* $\frac{90}{73}$*rds of the weight of the chloride of silver* (B).

To apply this to the example before discussed, suppose the weight of the mixed chlorides to be 24.5 grains, and of the chloride of silver 54.75 grains. From $\frac{76}{73}$rds of 54.75, or 57, take thrice 24.5, or 49, the remainder, 8, will be the grains of soda in the mixture.

From three times 24.5, or 73.5, take $\frac{90}{73}$rds of 54.75, or 67.5, the remainder, 6 grains, will be the potassa.

An equally simple method of calculation may be obtained without resort to algebra. By the second step of the analysis the chlorine in the mixed chlorides, of the metallic bases of the alkalies, is obtained, being $\frac{18}{73}$rds of the weight of the chloride; subtracting this from the weight of the mixed chlorides obtained by the first step, we have the weight of the metallic bases. Taking $\frac{2}{9}$ths of the weight of the chlorine, we have the oxygen re-

quisite to form the alkalies. Potassa contains $\frac{1}{6}$th, and soda $\frac{1}{4}$th of the weight of oxygen; $\frac{5}{6}$ths of the potassa and $\frac{5}{4}$ths of the soda, will be equal in weight to five times the oxygen, the weight of which has just been obtained. But potassa contains $\frac{5}{6}$ths of its weight of potassium, and soda $\frac{3}{4}$ths of its weight of sodium, and the united weights of these metals has also been obtained as above. Taking this latter sum from the former we find that *one half the weight of the soda is equal to five times the oxygen less the weight of the metals. One sixth of the weight of the potassa is equal to the weight of the oxygen, less one fourth the weight of the soda.*

Resuming the example before employed, in which the weight of the mixed chlorides is 24.5 grains, and of the chloride of silver 54.75 grains. The chlorine in 54.75 grains of chloride of silver is 13.5 grains. Subtracting this from 24.5 grains, we have 11 for the weight of the metallic bases of the alkalies. The oxygen equivalent to 13.5 grains of chlorine is 3 grains.

By the rule, 5×3 or 15, less 11, the weight of the metals, is half the weight of the soda; the soda is, therefore, 8 grains. The weight of oxygen, 3 grains, less one fourth of the soda, 2 grains, gives one sixth of the weight of the potassa. The potassa is therefore 6 grains.

It is readily seen that the general principle to which these results refer themselves, may be used with great effect in avoiding a difficult step in chemical analysis, by the substitution of a less direct, but more simple one, aided by easy calculations.

This problem is only a particular case of a general one, well deserving the attention of analytical chemists.

Essays on Meteorology. By James P. Espy, Mem. Am. Philos. Soc., &c.

No. II.

Theory of Hail.

On the principles established in the first essay, the spout, which is nothing but visible condensed vapour, may sometimes not reach entirely down to the surface of the earth, or sea, when the dew-point is too low for such an effect; in this case, it will appear as an inverted cone, reaching down from a cloud already formed.

It may here be observed, that a spout will always begin to be formed at a considerable elevation above the surface of the earth, because the vapour will always begin to condense there, from a law too well understood by meteorologists to need elucidation here. When, however, it begins to condense, it begins, also, by its diminished specific gravity, to rise, and then, if all circumstances are favourable, the cloud will increase as it ascends, and finally become of so great perpendicular depth, that, by its less specific gravity, the air below it, and contiguous to it, in consequence of diminished pressure, will so expand, and cool by expansion, as to condense the vapour in it; and then the air below this again, will, in its turn, experience a greater and greater expansion and refrigeration, and, consequently, condensation of vapour; and this process may go on so rapidly, that the visible cone may appear to descend to the surface of the sea, or earth, from the place where it first appears, in about one or two seconds.

The terms here employed must not be understood to mean that the vapour, or cloud, actually descends; it appears, to the spectator, to descend, but this is an optical deception, arising from new portions of invisible va-

pour constantly becoming condensed, while, all the time, the individual particles are in rapid motion upwards.

For the sake of illustrating the principle, without aiming at absolute numerical accuracy, let us suppose a dew-point ten degrees below the temperature of the air. Now, a diminished pressure of one pound to the square inch, will cause a fall of temperature of only six degrees, so that, in this case, the visible cone would not reach down to the surface of the earth, or sea, and the air would have to ascend a little more than 400 yards, before condensation would commence. I say *more* than 400, because, though the temperature sinks one degree for every hundred yards of elevation, the dew-point also sinks a little from the expansion of the air, and the same quantity of vapour occupying a larger space. But, if the dew-point in the above case had been only six degrees below the temperature of the air, then the spout, or visible cone of vapour, would have reached the earth.

Now, it is highly probable that a spout, in passing over the surface of the earth, would meet with slight variations in the dew-point, and, if so, it would rise as the dew-point fell, and fall as the dew-point rose; and thus the theoretical deductions correspond exactly with the facts.

Again, the direction of the two spouts, as also of the great storm with two veins of hail, mentioned in a former essay, was from the south-west to the north-east; and Pouillet says, that a large majority of these storms are known to move in this direction. I presume he means those which occur in France. Now, it is manifest that these storms, according to the theory, must move in the direction of the upper current into which they may ascend, for the top of the vortex will lean in that direction; and, as theory demonstrates, and observation agrees with that demonstration, that the uppermost current of air in the temperate zone moves constantly from the south of west, towards the north of east, this will satisfactorily account for the general tendency of these storms in that direction, all over the northern temperate zone, or, at least, above lat. 30°. For, from that latitude, down to the tropic of Cancer, the uppermost current of air moves nearly towards the north, and, within the tropic, it moves towards the north-west; and so the theory would lead us to presume that, in these regions, the storms will be found to move in these directions. Such is shown to be the fact by Mr. Redfield, as to all great storms which travel any considerable distance in the West Indies. And in the Philosophical Transactions, Lathrop's Abridgement, vol. 2, p. 107, it is said that hurricanes in the West Indies begin from the north-west, and terminate with a south-east wind.

It is quite reasonable to suppose that these spouts sometimes meet with a middle current, moving in a different direction from the uppermost, which will account for the exceptions to the general rule; for the spouts will, in such case, certainly lean, and, of course, move, in the direction of the middle current.

These three storms all occurred in the day, and two of them in the afternoon; and M. Pouillet says that many more occur in the day than in the night. Now, this is precisely what the theory would lead us to suppose, and the explanation of this fact affords me an opportunity of explaining the very commencement of those spouts which occur during the day. The sun, during the day, and especially in the afternoon, heats up the surface of the earth, and the air in contact with that surface, many degrees above the air, a few hundred feet above the earth. This heated air below, and cold air above, will form an unstable equilibrium, and a very slight agitation will cause to be formed upward vortices of the light air below, and

downward vortices of the dense air above. Now, if the dew-point is not more than ten degrees below the temperature of the air in contact with the soil, the air of the upward vortex will not ascend much above one thousand yards, before the refrigeration, caused by expansion, will cause a beginning of condensation of vapour; and the moment this occurs, the velocity of upward motion is rapidly increased, from the expanding effect caused by the evolution of latent caloric, as before explained.

If the dew-point of the air at this elevation should be almost identical with its temperature, the cloud of the upward vortex will go on increasing in size and perpendicular height, until the air immediately below it, being pressed downwards with less and less weight as the cloud above increases in height and levity, will, by expanding more than the air which preceded it in the vortex, be cooled down to the point of deposition, before it reaches the elevation of one thousand yards. And if, in this case, the vortex should rise to a height sufficient to produce a diminution of pressure under it of one pound to the square inch, the cone of visible vapour, or cloud, will reach down to a point four hundred yards from the earth's surface. And, in general, the nearer the dew-point is to the temperature of the air, the lower will the visible spout descend; so that, if they had been assumed only six degrees apart, in the above case, the apex of the spout would have descended to the earth. And, if they had been assumed still nearer together, the spout would not only have descended to the earth, but it would have been of some considerable size there. Thus we find that this mode of calculation not only enables us to account for the more frequent appearance of these spouts in the day than in the night, but also to assign a reasonable, hypothetical cause, why these spouts, or storms, are sometimes broad, and sometimes narrow, and sometimes even do not reach down to the surface of the earth.

It is known, also, that spouts, and violent storms, are always preceded by calms. This fact, also, is easily explained by the theory. For, in the first place, it is known that a calm favours the production of a high dew-point, which is an essential ingredient in these storms; and, second, a vortex of great strength cannot be formed, unless it can rise nearly perpendicular to a great elevation, which never can happen where there is a strong wind. This will readily be admitted, when it is considered that the wind is always stronger at some distance above the surface of the earth, than at the surface itself; and, therefore, no vortex of any great height, in these circumstances, could be formed, for the upper part would be blown away from the lower.

I have frequently seen those large columnar clouds, which form in mid air during a warm summer's day, have their tops blown off by an upper current, when the lower air was almost still, and thus a vortex of great strength prevented from forming. That these clouds are actually formed by rising vortices, occasioned by the disturbance of the equilibrium of the air during the day, is rendered almost certain by the following facts. First. When the supply is cut off in the evening, by the air near the surface of the earth becoming cold, these clouds cease to form, and not unfrequently disappear, and a day with many clouds is followed by a cloudless night. On the supposition of upward vortices, this phenomenon is very simple and natural; but on any other supposition, it is utterly paradoxical, (especially when it is now known that depression of temperature is the only cause of the condensation of aqueous vapour,) how clouds can be formed under a

meridian sun, which will be dissipated under the refrigerating influences of a nocturnal sky.

Second. I once saw, during a profound calm, those columnar clouds, in all parts of the heavens, appear to be coming slowly towards me, which I think can only be accounted for by supposing that they were all rising perpendicularly. These clouds, however, were gradually dissipated after they had increased to a considerable size, which proves beyond doubt that they were surrounded by air, at that elevation, whose dew-point was below the temperature of the air; and it may be added, that this is one of the cases where a spout cannot be formed, for the ascending air of the vortex will always, more or less, be mingled with the air through which it passes.

Again, nothing but an upward or a downward vortex will account for the well known fact, that, in these storms, the clouds are frequently seen to rush together with great rapidity, for some time, without overlapping each other, and crossing, which proves that they are on the same horizontal plane, and so demonstrates the existence of a vortex. I need hardly add, that other phenomena show that the motion, after meeting, is upwards, and not downwards.

Clouds have also frequently been seen to ascend, by spectators on mountains, and æronauts have found their temperature much higher than the surrounding air. Thus, it is demonstrated, beyond all doubt, that there is an upward current in these storms, whether the latent caloric given out by the condensation of the vapour, is the cause of that current, or not. And, as no fact in physics is better established than that precipitation will instantly take place, if saturated air is suddenly rarefied, we are sure, also, that this upward motion of saturated air will, by causing expansion, produce precipitation.

I had long been desirous to ascertain, by actual observation, how high these vortices carry the condensed vapour, or cloud, into the upper air, and a fine opportunity was afforded me, on the 31st of July, 1834. This morning, says my journal of that day, it began to rain early, with the wind and lower clouds north-east, middle clouds south, and upper clouds west. Several showers occurred during the morning, and the wind gradually shifted round to the south-east. At 5 o'clock, P. M., a most violent shower, which lasted about fifteen minutes, came up from the north-west, and at the moment of the hardest rain, the lower wind being strong from the north-west, the lowest visible clouds in a south-east direction, were seen to move with great velocity in the opposite direction, towards the north-west.

As soon, however, as the shower passed off to the south-east, the lower clouds changed their course, and followed the shower towards the south-east, exposing to view, near the zenith, a most magnificent columnar cloud, with its summit and western side as white as snow, being exposed to a western sun, in a perfectly clear sky. This cloud seemed nearly stationary for some time in its upper snowy part, while the scattering clouds in its lower parts were seen to rush under it, towards the south-east, with great velocity. The principal cloud moved slowly and majestically towards the ESE.; the sun's rays gradually climbing up this mountain of snow, fourteen minutes after he set, his last beams ceased to illuminate its summit.

The altitude of this summit being taken by a sextant, was found to be nine and a half degrees. The line which bounded light and darkness, as it rose up the sides of this columnar cloud, was well defined, the western horizon being entirely free from clouds, so that I think I could not be mistaken one-quarter of a minute in the time when the sun's rays ceased to

shine on the top of the cloud. Calculating from these data, I find the cloud reached to the amazing height of eleven miles, and that it travelled east-south-east, with a velocity of about forty-eight miles an hour.

A much more violent storm than this had occurred at Wilmington, (Del.) about twenty-eight miles south-west of Philadelphia, two days before this, as appears from Dr. Gibbon's Journal. He says it commenced raining with a thunder gust, at 5 o'clock in the morning, and poured down in torrents till half-past 7, when it ceased. In this short time, two and a half hours, $5\frac{1}{10}$ inches of water fell. This rain, he says, did not extend further than ten or fifteen miles from Wilmington, in any direction, except, perhaps, in an easterly course, in New Jersey.

On that evening, my journal says, "The upper clouds from the WSW. were tinged with pink, thirty-one minutes after seven o'clock, mean time. These clouds, being in the zenith, must have been the astonishing height of fourteen miles.

The angular velocity of one of these upper clouds was taken; it was found to rise from 25° to 32°, in two and a half minutes. Its absolute velocity, therefore, at this great height, was about two miles a minute. This great velocity is not at all inconsistent with the velocity with which storms are known generally to travel towards the north-east, in our latitude, even on supposition that this direction is given to the upward vortices of these storms, by this uppermost current, as explained before; for the inertia of the air in the vortices must be overcome, and, therefore, the velocity of the storm, at least the hinder part of it, cannot be so great as the velocity of this uppermost current.

There are many well authenticated accounts of showers of dust, and bloody, or, as I imagine, reddish rain, having fallen, and also of hail, with earthy or stony matter contained in the stones, and some with green leaves of forest trees; all these facts are mere corollaries from the theory. Prof. Zimmermann analyzed the sediment of some red rain which fell on the 3d of May, 1821, near Geissen, and found it to contain chrome, oxide of iron, silex, lime, carbon, and a trace of magnesia, but no nickel. On the 13th of August, 1824, in the city of Mendoza, in Buenos Ayres, dust fell from a black cloud, and at the same time, in another place, distant forty leagues, the same phenomenon occurred.

In Persia, near Mount Ararat, there fell, in the month of April, 1827, a shower of *seeds*, which, in some places, covered the earth to the depth of six inches. The sheep ate of it, and men made a tolerable bread of it. The French ambassador in Russia obtained some specimens of this grain, and sent them to Paris, where they were analyzed and examined by MM. Desfontaines and Thenard, and determined to be lichens of the genus Lecidea.

Now, as neither leaves of forest trees, nor seeds of lichens, can grow in the upper regions of the atmosphere, or be precipitated to the earth from any other planet, if these accounts are believed, and M. Pouillet doubts not the truth of them, then the existence of upward vortices, however these vortices may be formed, is established.—[Pouillet, p. 770.

The theory will also account for the water spout. Indeed, a spout at sea, and a spout on land, are identically the same thing, and many have been known to pass from water to land, exhibiting the same appearance in both situations. To show their identity, I will copy from Silliman's Journal, vol. xiv., p. 171, an account of a water spout seen off the coast of Florida, in the spring of 1826, by Benjamin Lincoln, M. D., of Boston.

"*April 5th.*—At 6 o'clock, A. M., an order was heard from the deck to

get ready the gun on the weather quarter, and bring the muskets from the cabin. Recollecting what region we were in, my first thought was of an engagement with a piratical cruiser, but on going upon deck, it appeared that our enemy was a water-spout, bearing north, distant, according to the captain's estimation, about two miles, and coming down upon us before a whole-sail breeze. One musket was fired at it, but it had nearly effected a retreat before we got ready for action. I had just time to see it, and it disappeared.

"In a few minutes another appeared, which was said by the officers of the vessel to be much more distinct than any one they had ever seen before. I observed it attentively, but neglected to note the time, except at its commencement, and the end of the third spout, which appeared after the second and principal one had passed away. This omission renders it impossible to give the duration of its different stages with any good degree of exactness. The wind came from the land, blowing a whole-sail breeze. The thermometer stood at 72°. A black cloud, from which the spout proceeded, extended along from east to west, its lower edge very distinctly defined, even, parallel to the surface of the water, and elevated 25° or 30° above the horizon. No other cloud was visible in that quarter, but a haziness covered the whole heavens.

"A small, black, and perfectly defined cone, darted from the lower edge of the cloud, and pointed perpendicularly to the water, which, at the same moment, was seen flying upwards like spray on the rocks, It was distinctly noticed that the cloud grew blacker near the cone, appearing to be gathered in from all quarters, and condensed at this point.

"After the lapse of two or three minutes, the cone instantaneously extended itself to about twice its first length, and the water was thrown up higher. This continued a few minutes; then the apex of the cone suddenly leaving the truncated end jagged, from which little scirrhi were continually darting and disappearing, the water continuing as before. This appearance lasted two or three minutes, after which the cone gradually elongated itself, assumed the cylindrical shape, except near its junction with the rest of the cloud, and descended almost to the surface of the water. The time occupied by the descent was about two seconds. All these changes were instantaneous, except the descent, which was gradual. As the spout descended, the agitation of the water increased, boiling up on each side of the end of the spout, but not coming in contact with it. The spout was slightly curved, the convexity of the curve being towards the point whence the wind came. It appeared to be hollow, light in the middle, and black, like the cloud, at its sides. A waving, ascending motion, was distinctly seen in the middle, more distinctly near the water than near the cloud. This the sailors, with one accord, pronounced to be water going up the spout.

"This appearance lasted fifteen minutes, or more, the spout remaining entire and unchanged. Then it began to fade, and suddenly a section from its lower end disappeared, leaving the same scirrous jagged extremity before mentioned. One section after another disappeared in this way, the spout continuing to grow paler, the waving motion growing more distinct and slow, and the agitation of the water subsiding, till the whole disappeared. By this time, the wind had freshened considerably, and the cloud had spread over a great part of the heavens. In a few minutes after, another cone appeared, exactly like the first in all respects, and the same appear-

ance was exhibited in the water under it. This continued a short time, and then disappeared.

"From the appearance of the first cone, till the disappearance of the last, was three-quarters of an hour.

"The wind continued to increase, and the cloud to gather blackness, and spread in every direction, till it enveloped the whole heavens. Next came a most vivid flash of lightning, with a most tremendous peal of thunder. It seemed as if heaven and earth had exploded at once, and in an instant all was calm, the sails hung loose, and not a breath of wind could be felt. Rain now began to fall, not in drops, but in torrents, and the wind came in gusts from every point of the compass. It continued to rain and blow in this way about fifteen minutes, after which it ceased, the wind in its former direction, the sky became clear, and we went on our way."

If any one will carefully examine the phenomena here described, and compare them with the two land-spouts described above, he will perceive their exact similarity in all the most important features,—the gathering in of the clouds at the upper end of the spout, where it lost itself in the cloud; the inverted cone of thick vapour descending; the commotion of the water, and the removal of the earth under the spout; and, above all, the rain that occurred after the termination of the spout.

It is worthy, also, of particular remark, that the rain lasted exactly the same length of time that the principal spout lasted, fifteen minutes, and probably it commenced thirty minutes after the spout, or fifteen minutes after its disappearance. And as this rain, and the spout, were undoubtedly parts of the same phenomenon, and if, according to the theory, the rain was condensed in the spout, and carried up by the spout, we are led to believe it must have been carried up a great distance, or it would not have taken thirty minutes to ascend and descend. It is true, that, in ascending, it would move upwards much slower than the vortex of air which carried it, for the drops would gradually increase in size in their upward motion, by the finer particles of condensed vapour constantly overtaking them in their course, and uniting with them, until, by their increasing size, and the diminishing force of the air, from its diminishing density, they would stop their upward motion, and be thrown off at the sides of the vortex, as explained before.

It is worthy of remark, also, that the suddenness with which "the cloud gathered blackness, and spread in every direction, till it enveloped the whole heavens," is easily and naturally accounted for by the outward motion of the vortex above, as explained in a preceding part of this essay. Even the direction in which the spout leaned, from the wind, could have been predicted from the theory.

In the Edinburgh Philosophical Journal, vols. v. and vi., are given descriptions and plates of water-spouts, which appear to me almost to demonstrate, of themselves, the theory here advanced. Several of these spouts were attended with rain, at the distance of about a quarter of a mile from the spout, and they all began to descend from the cloud in the form of an inverted cone, and gradually proceeded downwards to meet a smoke-like appearance, which rose from the surface of the water to meet it.

This cone was black at first, but, towards the end, it began to appear like a hollow canal; the sea water could, even while it was entirely black, be seen very distinctly flying up along the middle of it, as smoke does up a chimney, with great swiftness; and the wind, in all instances where men-

tioned, blew towards the spout below. These phenomena, with the exception of the hollow canal, have already been explained.

In the fourth volume of the Abridgment of the Transactions of the Royal Society of London, a description of many other spouts is given, attended with circumstances similar to those already described. One of these occurred in England, on the 3d of June, 1718. "It was stationary for a length of time not mentioned, and discharged an immense quantity of water, without thunder. It fell on a space about sixty feet over, and tore up the ground there seven feet deep to the rock, and made a deep gulf for about half a mile from that place, raising a stream below, so as to render it impassable." All this must have occurred in a few minutes, as, immediately on the appearance of the spout, some persons attempted to run home, but they found the brook already impassable.

By having deferred the publication of these essays so long, I am now enabled to refer to a highly interesting account of some water-spouts, seen by Lieut. H. W. Ogden, and communicated in the January number of Silliman's Journal.*

It was in May, 1820, in the edge of the gulf stream, the weather being very warm, and the atmosphere close and oppressive, when seven were seen in half an hour, varying in their distance from the ship, from two hundred yards to two miles. Lieut. Ogden says, "The atmosphere was filled with low, ashy coloured clouds, some of which were darker underneath than others, and from these the water-spouts were generally formed, each one from a separate cloud. In some instances, they were perfectly formed before we observed them, but, in others, we could see a small portion of the cloud, at first extend downwards, in the shape of an inverted cone, and then continue to descend, not very rapidly, until it reached the water. In other instances, however, we observed that this conical appearance of a portion of the cloud did not always result in the perfect formation of a water-spout. Several times we saw the cone project, continue for a short time stationary, then rise again slowly, and disappear in the clouds. This would, in some cases, occur two or three times to the same cloud; but, eventually, a larger and darker cloud would descend, and result in forming the visible spout, as above mentioned."

One spout passed within sixty yards of the ship, and, after having been visible more than twenty minutes, at the distance of about three hundred yards, its lower part became smaller, and then gradually rose, until entirely lost in the cloud, part of which still hung over them. Soon after this, several severe flashes of lightning struck near the ship, and the rain began to fall in large and very *cold* drops, perfectly *fresh*.

Bibliographical Notice.

The Naval Magazine, edited by the Rev. C. S. Stewart, M. A., aided by an Advisory Committee.

We hail with pleasure the appearance of the first number of a periodical bearing the above title. There can be no doubt but that a journal devoted to the objects and interests of naval science, and naval men, will produce the happiest results. We trust that a feeling of esprit de corps will connect itself with this publication, and that officers will be induced to exertion for

* See also Naval Mag. No. 1, vol. I.

the purpose of contributing to their *own* magazine, which they might not be disposed to make for one not purely professional. To this journal we must look for information as to those means best calculated to improve this important branch of our national defence. A naval school, ably and warmly urged, would, we feel satisfied, be brought nearer to its establishment, than by awaiting the slow progress of public opinion, now beginning to move decidedly in its favour. Independent criticism of existing defects; judicious observations on the merits or defects of the services of other nations; suggestions of improvements in naval science or practice; details of nautical operations, and of those matters of practical science which are connected with the profession, will afford, of themselves, a most abundant field of usefulness. Literature will strew some of her flowers over these more rugged paths, and sketches of scenes on shipboard, or on land abroad, lend interest even to the general reader.

An earnest is given of co-operation with us in meteorology, a branch which naval men have so strong a necessity to study, and such excellent opportunities of studying to good purpose, by the publication of the meteorological circular of the Joint Committee of the American Philosophical Society and Franklin Institute, and of a meteorological table for January, 1836, by Dr. William Swift, of the New York naval station.

We look with interest for the appearance of the new work, announced in the pages of the journal, on navigation, by passed midshipman Maury, of the United States' navy. B.

Franklin Institute.

Monthly Conversation Meeting.

The sixth monthly conversation meeting of the Institute, for the season, was held at their Hall, February 25th, 1836.

Mr. Franklin Peale exhibited a working model of a press, for cutting out coin, intended to be worked at the United States' Mint, by steam power. Specimens of a medal struck in commemoration of the first steam coinage, were presented.

Messrs. B. Slater & Co. submitted for examination, a patent stop motion for roving frames, invented by T. and J. O. Lewis, of Wilkinsonville, Mass. The stop was simple and effective.

A model of a canal boat, by Mr. A. Mason, of Pittsburgh, was upon the table.

Col. B. Chew, Jr. made some general remarks in regard to the working of the salt springs of Pennsylvania, inviting inquiry into the source of the brine, with a view to what he considered might be a more effective mode of obtaining salt.

Mr. John C. Cresson presented a specimen of Alabama cotton, in the pod.

Prof. A. D. Bache showed the action of a safety alarm for steam boilers, described by him in the Journal of the Institute in 1832, and recently made the subject of experiment by the Committee on the Explosions of Steam Boilers.

REPORT OF THE COMMITTEE OF PREMIUMS AND EXHIBITIONS.

Ninth Exhibition of Domestic Manufactures, held by the Franklin Institute, of the State of Pennsylvania, for the Promotion of the Mechanic Arts.

To the Managers of the Franklin Institute.

The Committee on Premiums and Exhibitions report—

That the Ninth Exhibition of the Institute was held agreeably to the announcement of the Board, on the 7th, 8th, 9th and 10th of October.

In presenting the result of their labours, the committee have great pleasure in congratulating the Institution and the community upon the rapid advancement to perfection in many branches of industry, of which they have received evidence from the display now closed. To those whose intimacy with the progress of these exhibitions of the Institute, enables them to recur to the state of the arts in this country, as evinced at its early exhibitions, the decided superiority of the fabrics of the present day, is peculiarly striking, and it must be a source of no small gratification to them to reflect how much the country is indebted to the exertions of the Institute, in producing this improvement, by exciting emulation among the producers, and by introducing their fabrics to the notice of the consumers.

In furtherance of the objects which this Institute have had in view, results of a similar character have been had in our sister city, New York, by the exertion of similar institutions, and the committee take this opportunity to express their satisfaction at the good feeling which exists between them and this society. Delegations from the American Institute, whose fair was held during the week subsequent to ours, and from the Mechanics' Institute, whose fair had been previously held, visited the Exhibition of this Institute. The good feeling thus expressed was reciprocated on our part by sending a delegation to the fair of the American Institute, and it is to be regretted that circumstances prevented our sending one to that of the Mechanics' Institute also.

If at the exhibition of this institution just closed, the number of specimens presented was not so great as on some former occasions, it must be attributed to a cause at which all will rejoice. The uncommon prosperity of the manufacturing community has prevented many who usually contribute their share to enhance the splendour of our shows from presenting samples of their work, in very many branches of industry, the manufacturers have found themselves during the past summer unable to keep pace with the growing demand.

Of the Premiums offered by the Institute in the printed list, a large number have been claimed by competitors which the committee, after a fair investigation of their respective merits, by disinterested judges, appointed for that purpose, have awarded as follows.

Cotton Goods.

Premium No. 75. For the best samples of checked and corded muslin, is awarded to Joseph Bancroft, of Wilmington, Del. for specimen No. 222, decidedly the best of the kind that had come under the notice of the judges.

Premium No. 82. For the best samples of rich chintz prints, for ladies' dresses, is awarded to Philip Allen, of Providence, R. I. for specimen No. 174, of which the judges remark that the style is excellent, the colours brilliant, and the printing accurate.

Premium No. 85. For the best samples of cotton handkerchiefs, in imitation of Madras, to measure square, of cotton yarn not under No. 40, is awarded to William H. Cheetham, of Philadelphia county, for specimen No. 38, superior, in the opinion of the judges, to any before exhibited.

Premium No. 86. For the best samples of 4-4 fancy striped or checked ginghams, in imitation of Scotch; of yarn No. 40 or upwards, is awarded to William H. Cheetham, of Philadelphia county, for specimens No. 35, 36 and 37, being superior, in fineness of texture, colouring, and general finish, to any that have before come under the notice of the judges.

Premium No. 90. For the best samples of pantaloon stuff, 3-4 to 7-8 wide, all cotton, or cotton and wool, is awarded to William H. Cheetham, of Philadelphia county, for specimens No. 33 and 34, which closely resemble the foreign article, and were much sought after during the past summer.

Woollen Goods.

A certificate of honourable mention is awarded to W. & D. D. Farnum, of Waterford, Mass. for specimen No. 140, a small piece of sattinet, of which the judges remark that it is not surpassed by any similar article which has ever come under their inspection. Had the quantity of this article been sufficient, it would have been entitled to the premium.

A certificate of honourable mention is awarded to the Pequonnock Company, Bridgeport, Mass. for specimens No. 156, three printed table covers, which the judges pronounced to be highly creditable specimens of a new branch of manufactures.

Carpets.

Premium No. 106. For the best sample of Venetian carpeting 27 or 36 inches wide, is awarded to Isaac Macauley, of Philadelphia, for specimen No. 342, extremely well manufactured, chain very fine, colours good.

Premium No. 107. For the best specimen of Brussels carpeting, 27 or 36 inches wide, is awarded to Isaac Macauley, of Philadelphia, for No. 487, one piece of well manufactured goods, showing considerable improvement since the last exhibition.

A certificate of honourable mention is awarded to Miss Sarah Ann Fling, of Philadelphia, for specimen No. 593, a hearth rug, exceedingly well manufactured, and handsome design.

Silks and Laces.

A certificate of honourable mention is awarded to Joseph Ripka, of Philadelphia, for specimen No. 346, a small parcel of sewing silk of excellent quality, but not in sufficient quantity to be entitled to the premium.

A certificate of honourable mention is awarded to Boswell and Crowley, of Philadelphia, for specimen No. 312, a lot of pongee handkerchiefs dyed by them upon which much commendation was bestowed for the beauty and regularity of the colour.

Straw Bonnets.

The Silver Medal of the Institute is awarded to Miss E. White, of Philadelphia, for specimens No. 122, several straw bonnets, which were much admired for neatness of style and excellence of quality.

Surgical Instruments.

The display of Surgical Instruments was very extensive, and afforded gratifying evidence of the high state of perfection attained in this branch of the arts. Two sets of amputating instruments, No. 256, made by Wiegand and Snowden, and No. 298, made by George P. Schively and Co. both of Philadelphia, were selected by the judges as most worthy of premium No. 52; but upon a minute comparison, their merits appeared so nearly balanced that it was impossible to determine which was best. Under these circumstances the committee have awarded to George P. Schively and Co. a certificate of honourable mention; Mr. Wiegand being a member of the Board, cannot, under the regulations of the exhibitions, receive any award.

A certificate of honourable mention is awarded to John Rorer and Son, for specimen No. 488, a lithontriptic instrument, admired for its high finish.

Cutlery.

Premium No. 60. For the best saddlers' tools, is awarded to J. English and H. & F. A. Huber, of Philadelphia, for specimen No. 12, an assortment of saddlers' tools, which were pronounced by the judges superior to those usually imported.

A certificate of honourable mention is awarded to N. P. Ames, of Springfield, Mass. for specimens No. 407, five swords of excellent quality and finish.

A certificate of honourable mention is awarded to F. W. Widmann, of Philadelphia, for his specimens of sword mountings, which are highly creditable to the maker for the chasteness of the design and beautiful finish of the work.

A certificate of honourable mention is awarded to Rochus Heinisch, of New York, for specimens No. 249, several pair of compound lever shears, the form of which was correct, and the polish very perfect.

Hardware.

Premium No. 41. For the best brass wire of assorted sizes, from No. 70 to 25, is awarded to Holmes, Hotchkiss, Brown and Elton, of Waterbury, Conn. for specimen No. 281.

Premium No. 55. To the maker of the best stock or standing vice, equal to those known by the name of tower vices; is awarded to A. Lamont, of Pittsburg, Pa. for specimens No. 166, five bright vices, which will not suffer by comparison with the celebrated vice adopted as a standard.

Premium No. 57. For the best wood screws of iron or brass, assorted sizes, from one-fourth of an inch to 3 inches, is awarded to J. G. Pearson and Brother, New York, for specimens No. 267, an assortment of wood screws, fully equal in cutting and finish to those usually imported from England.

Premium No. 58. For the best screw augurs, assorted sizes, from two to eight quarters; is awarded to David Basset, of Derby, Conn. for specimens No. 378, which the judges believed would give entire satifsaction to the mechanic, and exclude foreign competition.

Premium No. 70. For the best portable scales, to weigh from 3 lb. to 12 cwt. is awarded to E. and T. Fairbanks and Co. of St. Johnsbury, Vt. for specimen No. 157, a portable platform compound lever scale, which long experience has proved to be extremely accurate.

A certificate of honourable mention is awarded to Joseph Nock, of Philadelphia, for his fire-proof chest lock, ingeniously devised to sound an alarm.

A certificate of honourable mention iis awarded to Scovill and Co. of Waterbury, Conn. for their specimens of brass hinges, which are rapidly driving the foreign article out of the market.

A certificate of honourable mention is awarded to Webster and Co. of Albany, New York, for their specimens of enamelled hollow ware, which they have succeeded in bringing to great perfection.

A certificate of honourable mention is awarded to D. Simmons and Co. of Albany, New York, for the specimens of edge tools, of their manufacture, which were judged equal in quality and general finish to any made in this country, and much superior to the imported article.

A certificate of honourable mention is awarded to Rockwell and Hinsdale, of Winchester, Conn. for their scythes and straw knives, which were highly commended by the judges.

A certificate of honourable mention is awarded to Thomas and Benjamin Rowland, of Cheltenham, Philadelphia county, for specimens of shovels and spades, and of long saws, which justly bear a very high reputation.

A certificate of honourable mention is awarded to Israel White, of Philadelphia, for an assortment of carpenters' planes, finished in a very workmanlike manner.

A certificate of honourable mention is awarded to Edward W. Bushnell, of Philadelphia, for his specimens of gauges and squares; tools much in demand, and possessing all the requisite qualities to insure good work.

Silver Ware.

A certificate of honourable mention is awarded to R. and W. Wilson, of Philadelphia, for the chasteness and beauty of their specimens of silver ware, which were much admired.

There was also an extensive assortment of this beautiful ware, from the manufactory of Fletcher and Bennett, which contributed much to enhance the splendour of the exhibition, but as Mr. Fletcher is an officer of the Institute, he is precluded from competition.

Saddlery.

A certificate of honourable mention is awarded to James E. Brown, of Philadelphia, for specimen No. 67, a set of coach harness, very neat and creditable to the maker.

A certificate of honourable mention is awarded to A. M. Wagner, of Philadelphia, for specimen No. 120, a gentleman's saddle, esteemed by the judges a very superior article.

A certificate of honourable mention is awarded to T. Benninghove, of Philadelphia, for specimen No. 381, a fancy bridle and martingale, a very difficult and well executed piece of work.

Stoves and Grates.

A certificate of honourable mention is awarded to Joseph Snyder, of Philadelphia, for specimen No. 414, a parlour grate of very neat pattern, and designed to economize the heat by means of a circulating air chamber.

A certificate of honourable mention is awarded to R. Pierpont, of Taunton, Mass. for specimen No. 72, a doric fire-place, favourably spoken of by those who have given them a trial.

Philosophical Apparatus.

The silver medal of the Institute is awarded to William J. Mullin, of New York, for his specimens of watch dials, a very beautiful article.

A certificate of honourable mention is awarded to Alva Mason, of Philadelphia, for his specimens of philosophical apparatus.

A certificate of honourable mention is awarded to Isaac Schnaitman, for his improved double lens spectacles, highly approved by the judges.

A certificate of honourable mention is awarded to Thomas Ewbank, of New York, for his syphons, which will be found very useful in transferring liquids. The judges suggest that these should be referred to the Committee on Science and the Arts.

Guns.

Premium No. 7, to the maker of the best rifle gun, with percussion lock, and double or hair trigger, to carry balls from 60 to 100 to the pound, is awarded to Allen & Ball, of Springfield, Mass. for specimen No. 212, an examination of which, by competent judges, could not fail to procure for it high commendation. Several other specimens were presented by Messrs. Allen and Ball, which bore testimony that they came from a master hand.

Models and Machinery.

A certificate of honourable mention is awarded to S. Gerhard, of Camden, N. J. for No. 566, a machine to facilitate the manufacture of shoes, which evinced much ingenuity.

Lamps.

Premium No. 30, to the maker of the best and most extensive variety of mantel, astral, or hanging lamps, is awarded to Christian Cornelius and Son, for the rich and beautiful exhibition of these articles, from their workshops, equal in beauty and excellence to any of foreign manufacture.

This country is much indebted to Messrs. Cornelius, for the advanced state which this useful art has attained.

Musical Instruments.

After an elaborate and careful comparison, the judges report, that they would be guilty of great injustice to more than one maker, were they to recommend the award of a premium to any specimen exhibited; so near did they approach each other in excellence, a great improvement being manifested in all the instruments since last exhibition. Certificates of honourable mention are therefore awarded to Messrs. Conrad Meyers, C. F. L. Albrecht, E. N. Scherr, Groves and Wohlen, William Feuring, Loud and Co. and Thomas Loud.

In one of the pianos exhibited by Loud & Co., a new arrangement has been introduced, under the name of compensating tubes, intended to sustain the instrument in tone through different changes of temperature. This is considered, by the judges, one of the greatest improvements that has been effected in this instrument for a long time. But, as it is an invention coming more directly within the province of the Committee on Science and the Arts, it is referred to them for the purpose of receiving, if original, the Scott's legacy premium.

Paints and Colours.

The silver medal of the Institute is awarded to George C. Osborne, of

Philadelphia, for specimen No. 13, a case of water and oil colours in cakes. By the latter production, Mr. Osborne has supplied a want long felt by artists. It is deemed by the judges a very important invention, being much more convenient for landscape and miniature painting, than any other mode of preparation.

Several gallons of copal varnish were offered in competition for premium No. 117; this will be subjected to the test of twelve months' use, according to the terms of the premium, and the results made known in a future report.

China and Glass.

Premium No. 23, to the manufacturer of the best specimens of porcelain, is awarded to Judge Hemphill, of Philadelphia, for the assortment of this beautiful ware from his manufactory, most of which exhibited a decided improvement since the last exhibition, and will compare advantageously with the French china.

Certificates of honourable mention are awarded to the New England Glass Company, and to the Boston and Sandwich Glass Company, for their specimens of glass ware, considered by the judges highly creditable to the manufacturers.

A certificate of honourable mention is awarded to George Drummer, of Jersey city, for specimens of astral lamp shades, some of which were of extraordinary size.

A novel and interesting exhibition was furnished from the pottery of Mr. Abraham Miller, of Philadelphia, consisting of a variety of specimens of black and red earthenware, in the various stages of its manufacture, from the crude material to the finished ware.

Marble Work.

Premium No. 128, for the best urn in marble, for a monument, is awarded to James Stewart, a lad in the employ of Mr. John Struthers, for specimen No. 248.

A considerable variety of marble mantels was presented at this exhibition, an examination of which affords conclusive evidence that home-bred artists can produce specimens of ornamental carving, equal in richness and elegance to any that can be obtained in foreign countries. The merits of the different mantels exhibited was so nearly balanced, that a premium could not justly be awarded to any one. The committee have, therefore, awarded certificates of honourable mention to Messrs. Tennant & Highlands, for specimen, No. 214, and to Vanderbill, Bacon & Wilde, for specimen, No. 347.

Two carved mantels, No. 437, and a carved tablet, No. 476, intended for a mural monument, were exhibited by John Struthers. These were both excellent specimens of work, but as Mr. Struthers is a member of the Board, he is precluded from receiving any award.

A certificate of honourable mention is awarded to David G. Wilson, a lad in the employ of Mr. Henry Sailor, for specimen No. 96, a piece of carving, which affords promise of future eminence in his occupation.

A certificate of honourable mention is awarded to John Batten, for specimen No. 250, a bust of William Strickland; and No. 261, a head of Ariadne, in relief; the execution of which confers much credit upon the sculptor.

Cabinet Ware.

A certificate of honourable mention is awarded to James Kite, of Philadelphia, for specimen No. 145, a writing desk, made of a variety of American woods, introduced with skill and good taste.

There were several other specimens of cabinet ware exhibited, which, both in style and workmanship, were creditable to the makers, and fully sustained the character which Philadelphia has borne of preeminence in this branch of manufactures.

Leather, and Manufactures of Leather.

Premium No. 113, for the best specimens of white sheep skins, suitable for apothecaries' use, finished equal to that now imported from France, is awarded to Doyle & M'Neely, of Philadelphia, for specimen No. 306, two dozen skins, well got up.

A certificate of honourable mention is awarded to Doyle & M'Neely, of Philadelphia, for specimen No. 305, two bundles of morocco boot leather, of very superior quality.

A certificate of honourable mention is awarded to J. P. Alberger, of Philadelphia, for specimen No. 144, a russet trunk, well finished, and substantial.

Hats.

A certificate of honourable mention is awarded to C. F. Raymond, of Philadelphia, for his specimen of four dollar hats, the quality of which was very superior, and would have entitled him to the premium, had he exhibited the requisite quantity.

Certificates of honourable mention are awarded to Thomas Elmes & Co. and to Wilson & Laing, for their specimens of silk hats, pronounced, by the judges, the best exhibited.

A certificate of honourable mention is awarded to Brown & Siddons, for the improvement manifested in the hair seal caps manufactured by them.

A certificate of honourable mention is awarded to J. Chandler Smith, for the superior six dollar and nine dollar hats exhibited by him.

A certificate of honourable mention is awarded to E. Kimber, Jr., for his specimens of fur bonnets.

Books and Stationary.

Premium No. 13, to the maker of the best white vellum quarto post papaper, made from the best No. 1 domestic rags, weighing not less than eight pounds per ream, is awarded to the Brandywine Manufacturing Company, for specimen No. 189.

The other articles of stationary were numerous, and some of them very creditable to the trade, but there was nothing among them requiring a special award.

Fancy Articles.

The silver medal of the Institute is awarded to John Yard, Jr., of Philadelphia, for his beautiful display of pearl work, in the manufacture of which he has attained great perfection.

The silver medal of the Institute is awarded to the Pennsylvania Institution for the Instruction of the Blind, for the general assortment of their manufactures, an inspection of which affords pleasing evidence that the individuals who compose this unfortunate class are capable of becoming useful members of society.

A certificate of honorary mention is awarded to Reuben S. Gilbert, of

Philadelphia, for specimens of engraving on wood, evincing very great improvement in this art.

A certificate of honourable mention is awarded to the pupils of the north-western public school, for specimens of lace work, of superior quality.

Paper Hangings.

A certificate of honourable mention is awarded to Charles Longstreth, of Philadelphia, for his varied and beautiful display of paper hangings, which do much credit to his skill and good taste.

The brevity required in this report necessarily excludes a great variety of interesting articles, which deserve commendation; but as the committee intend availing themselves, as far as practicable, of the reports of the judges, for future publication, the merits of these will be more fully and satisfactorily discussed.

The committee cannot close their labours without expressing their obligations to the gentlemen who composed the committees of arrangement, and of judges, for their exertions in forwarding the views of the Institute, and promoting the great cause in which it is engaged.

All which is respectfully submitted.

Samuel V. Merrick,
Joshua G. Harker,
William H. Keating,
Frederick Fraley,
Isaac B. Garrigues,
Alexander McClurg,
Alexander Ferguson,
John C. Cresson,
Committee on Premiums and Exhibitions.

Mechanics' Register.

AMERICAN PATENTS.

LIST OF AMERICAN PATENTS WHICH ISSUED IN OCTOBER, 1835.

With Remarks and Exemplifications by the Editor.

1. For an improvement in the *Double Speeder;* William Field, North Providence, Providence county, Rhode Island, October 6.

This improvement "consists in a plan of compressing the roving on the spool so hard, or compact, that the same quantity may be put on a spool of only one-fifth of the common size. A machine with this improvement will occupy only one-half of the room, will require much less power, and will run at least one-third faster than common speeders." The usual plans for drawing, twisting, and winding, the roving, are followed; but the spools are run faster than the flyers, to take up the roving, instead of permitting them to fall back, in the common manner. The flyers are supported wholly above and independent of the spindles, are about one-half the usual length and diameter, and have a hoop at their lower ends to prevent their expanding.

The condensation of the roving is effected by the pressure of a thin, circular, plate against it, as it is wound on the spool; the plate being about the same diameter as the spool.

The claims are to "the plan of compressing roving on spools by circular plates, having a rotary motion, acquired by their pressure on the spools, the edges of which act on the roving as it is received from the flyers, and thereby condense it, so that a much greater quantity can be deposited on spools of the same size. The sliding rail in the rear of the spools, on which the circular plates are placed, and the connection between the increasing size of the spools, and the traverse motion of the belt guide, so that the spools may cause the variation of speed which their constantly increasing size requires. The application of a heart motion for traversing the spools, so formed as to cause them to rise with greater velocity than they fall, so that a less quantity of roving may be deposited on the spools when rising than when falling."

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2. For an improvement in *Lamps;* Samuel Rust, city of New York, October 6.

The improvement here described is to be applied to lamps with flat wicks, and consists of a notched roller for raising the wick, the roller crossing it near its upper end, and being turned by the finger and thumb. We are much mistaken if such a contrivance has not been previously in use, for the same purpose.

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3. For *Glazing or Preparing Pelisse Wadding;* Stukely Turner, Cranston, Providence county, Rhode Island. First patented July 25th, 1833; patent surrendered, and reissued upon an amended specification, October 6.

At p. 37, vol. xiii., we gave a sufficiently full account of this apparatus, and remarked that it did not contain any claim; the surrender and reissue thereof is intended to cure this defect, the following claims being now made.

"Of the above described apparatus, I claim as my invention the improvement of taking the cotton from the carding machines, and carrying it on an apron, or aprons, to the first glazing roller. I also claim the placing at the other end of the machine, a second glazing roller, with two upper rollers, all constructed like the first, to glaze the other side of the sheet of cotton. I also claim the placing two pressing rollers, instead of one, over each glazing roller. I also claim the carrying the cotton to the second glazing roller by an apron, after it has passed over the first glazing roller, and of carrying the cotton after it has passed over both glazing rollers, and been glazed on both sides, on an apron, until it is sufficiently dried, and the rolling it on a beam, which is revolved by the friction of the last mentioned apron."

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4. For a *Planing Machine;* Reid R. Throckmorton, city of New York, October 6.

This machine differs from those which have preceded it to such an extent as, in our opinion, to merit the character of novelty; that of utility it must acquire, if at all, by its actual performance. The general arrangement of the apparatus only, is shown by the specification and drawing; but, if constructed from these, most of the details would have to be invented by the builder, as the information given is very defective in this respect. The plane is to be about three feet long, and its face is to be a segment of a circle, of about eight feet in diameter, and there are to be seven, or more, plane irons, or cutters, extending from it, of such width as may be necessary.

To the upper part of the plane, a rod, or shackle bar, is attached, the other end of which is moved by a crank, thus causing the plane to traverse, or rather to vibrate, backward and forward, with a rocking, or curved, motion. How the cutters are to be kept upon the plank, and caused to cut to a proper depth, does not appear, as, in the drawing, they are represented as standing out like knives, far below the face of the plane. Tongueing and grooving is to be effected in a similar way, by cutters operating laterally, and moved by a crank. The claim is to "the peculiar construction of the plane, and the nature of its motion, being vibratory and rectilineal," &c. There must be more in this machine than is described in the specification, or than meets the eye in the drawing, or it will be found of little value.

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5. For *Fire-places and Furnaces;* Ebenezer S. Greely, Dover, Penobscot county, Maine, October 6.

The patentee calls this an air fireplace, and says that the improvement is founded on its construction, and conveying heat from one room to another, without any risk of fire, &c. The whole affair consists in having the top, hearth, back, and jambs, of the fireplace, hollow, conducting air into them from without, and distributing it, when heated, by means of pipes. There is not any claim made to this mode of constructing fireplaces, and we presume that there are but very few of our readers who are not aware that, so far as our description goes, there is nothing to claim; the same may be said of the whole, as specified.

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6. For a machine for *Thrashing and Cleaning Clover, or Rice;* Moses Davenport, Phillips, Somerset county, Maine, October 6.

The machine here described consists of a long trough, containing the feeding, rubbing, and other apparatus. It is too complex for verbal description, but its characteristic feature appears to be, the passing of the seed between rubbing boards, covered with perforated metal, or otherwise made rough, the lower board being stationary, and the upper one, as it vibrates, bearing on the seed in one direction only, it being raised in the return stroke.

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7. For an improvement in the mode of *Rearing Silk Worms;* Gamaliel Gay, Poughkeepsie, Dutchess county, New York, October 6. (See specification.)

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8. For an improvement in the *Saw Mill;* Uri Emmons, city of New York, October 6.

The proposed improvement consists in hanging the saw, without employing a saw frame, and in using springs to counteract the weight of the saw, the pitman, and other appendages. The spring it is proposed to make of wood, and to fix it like that of a pole lathe. The saw is to have a jointed lever extended back from it, both at top and at bottom; these, when the saw is down, will be at right angles to it, and as they rise in a segment of a circle, will draw the saw back, so as to allow the feeding of the log. Both above and below the log, the saw is to pass between cheeks, or guide pieces, to keep it steady.

The claim is "to the construction and application of the first described spring to the common saw gate; and also the construction of the second

described apparatus in every respect, as they may differ from any thing else before used or known," &c.

The law requires that the patentee should distinguish his invention from all other things before used, or known; but, in the case before us, this task is put upon the public, a task from which they ought to be relieved, as it would impose upon them the ungrateful necessity of informing the patentee that saw gates have been sustained by reacting springs; that saws have been hung without frames, by vibrating levers; that guides, such as he has described, have often been used, and that they, therefore, are unable to discover any thing novel in his invention.

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9. For a *Chaffing Thrashing Machine;* Russel Bradley, Williston, Chittenden county, Vermont, October 6.

We cannot afford more lines to this apparatus than there are pages in the specification of it. The unthrashed straw is to be laid lengthwise in a feeding trough, where it comes into contact with a revolving cylinder, carrying circular saws, at short distances apart, serving to cut the whole into chaff; it then descends to a thrashing cylinder, and thence passes through a winnowing machine of the ordinary construction. The claim is to the application of the circular saws.

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10. For a *Spring Saddle;* Joel Woodward, Marshalton, Chester county, Pennsylvania, October 6.

The spring part of this saddle is confessedly similar to such as are already in use, consisting of a flat side, having a spring wound spirally round it; the claim to *improvement* is merely in the mode of putting the parts together by screws, so that they may be easily separated. The kind of spring used was made the subject of a patent about a year or two ago; the present patentee cannot, therefore, adopt it as his own, merely because he has put it together in what he deems a more convenient way. If the patent alluded to was for a plan previously known, and belonging to the public, he may certainly sustain what is new in his own mode.

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11. For a machine for *Shaving Staves, Heading, and Shingles;* John Everhart, Jacob Pearson, John Morford, and Nathan Everhart, Warren county, Ohio, October 6.

The specification of this instrument is laboured, but obscure; the drawing is very well executed, but does not exhibit the parts in detail sufficiently to make up for the defects in the description; the general construction of the apparatus, however, may be collected from the two; but we shall not dwell upon it, as it does not present any thing which, in our opinion, bespeaks it equal to several other machines for the same purpose, although it is the joint production of no fewer than four *inventors.* The articles to be shaved are laid upon a solid bench, and are forced to pass under fixed knives, by a lever, which is drawn against them by a badly constructed endless chain of iron, producing more than double the friction that is necessary. The claim is limited to this endless chain, and the cogged shaft by which it is to be drawn forward.

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12. For *Distilling Alcohol from Apples;* Anson Walcott, Bloomfield, Ontario county, New York, October 6.

The pommage is to be put into a steam-tight tub, into which steam is to

be admitted through a tube, which descends nearly to the bottom of it; a series of vessels, similarly connected by tubes, and perfectly resembling Woulfe's apparatus, is terminated by a condensing worm. The three last vessels, as represented, are to be hollow globes of metal, placed within open tubs, the water in which is to be sufficiently warm to keep the alcohol in the state of vapour, as, otherwise, it would condense in the hollow globes.

The claim is to "the application of steam in extracting alcohol from apple pommage, without first making it into cider, and the globular metallic condensers."

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13. For a *Plough;* William Walker, Washington, Columbia county, Pennsylvania, October 6.

The claim is to "the peculiar formation of the sheath, or standard, and the projections on the inner side of the mould-board, which give the sheath, or standard, a leaning position, and cause the plough to take land."

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14. For an improvement in the art of *Cutting, or Dividing, India Rubber;* William Atkinson, city of New York, October 6.

The improvement in the art, or process, of cutting India rubber, preparatory to dissolving it, consists in putting it into a machine, such as is used for the preparation of paper stuff, by the paper makers. The patentee says, "I do not claim to be the inventor of the machine employed by me, or any part thereof; but what I do claim is an improvement in the art of dividing, or cutting up, India rubber, preparatory to the dissolving thereof in any proper menstruum, either in the common paper machine, or in a machine made for the express purpose, and operating substantially upon the same principle."

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15. For a machine for *Laying Ropes;* John Goulding, Boston, Massachusetts, October 10.

A machine for laying ropes of three or more strands is necessarily complex; the specification before us contains fifty-one references to the drawings, which fully exhibit the construction of the whole of the apparatus. The claim is to the combination and arrangement of the several parts, as described. There are several machines patented, both here and in England, the operating parts of which strongly resemble those which are the subject of the present patent; the combination claimed may, probably, be sustained, but we believe that the patentee must, in this case, limit himself to the precise modes described by him.

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16. For an improvement in the machine for *Hatchelling Hemp, Flax, Tow, or Manilla Grass;* John Goulding, Boston, Massachusetts, October 10.

A patent issued to Mr. Goulding, on the 17th of August, 1835, for a machine for the above purpose, which he has since improved by the addition of a cylinder, which is said to render it more effective; to this addition, his specification and claim, under the present patent, are confined.

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17. For a *Horse Power;* Moses Davenport, Phillips, Somerset county, Maine, October 10.

The claim under this patent is to "the method of construction, or combi-

nation, by which the several parts of the jointed platform are put together; of the cylinder heads, and of the friction rollers." This combination in most of its parts, exists in numerous other endless platforms; the peculiarities of the one before us, ought, therefore, to have been pointed out, as upon these alone could any valid claim be founded.

18. For a *Tin Oven;* Nathaniel D. Whitin, city of New York, October 10.

The oven, as represented in the drawing, is in the form of a common closet, with shelves; we are told, however, that it may assume various shapes, the claims made being to certain flat flues, and other appendages for conveying and regulating the heat, which are not, by any means, well described. The fuel is to be charcoal, and the furnace part, for receiving it, is to be so constructed that the combustion may, by an additional grate, be confined to the upper compartment of the shelved closet, or, when necessary, descend lower. The drawing is well enough as a picture, but it does not make the construction clearly known.

19. For a *Cooking Stove;* Elnathan Samson, Pierpont, St. Lawrence county, New York, October 10.

This stove is to be used as an open stove, when desired; but, like many others, it has doors in front, by which it may be closed. The oven, boilers, &c., are clearly described, and well represented, but there is an entire absence of every thing like a claim. We are told, however, that the improvements will be obvious from the description, and to the patentee this may be the case; he has erred, however, in not enlightening others, by designating these improvements, as the law requires he should do; obvious as they are said to be, we cannot point them out.

20. For a machine for *Hulling and Cleaning Clover and Timothy Seed;* Asa Burgess, and Herman Baldwin, Washington, Litchfield county, Connecticut, October 10.

Ten pages are devoted to the description of this machine, but our remarks upon it will be as brief as the specification is prolix. The feed is to be regulated by sliding boards, not differing essentially from such as are already in use. The seed is to be rubbed out by a revolving cylinder, furnished with points, or teeth; and below this there is a fan, so enclosed and constructed as to blow the chaff and dust away, without annoyance to the operator. The claim is sufficiently comprehensive, extending to many points in its construction, and also the situation in which it is to be placed in a building, for the purpose of blowing the chaff entirely out of it.

21. For *Applying Hydraulic Power;* Robert Mills, Washington city, and Henry B. Fernald, Portland, Cumberland county, Maine, October 10.

The rising and falling of the tide is to be employed for the purpose of condensing atmospheric air, which condensed air is to be afterwards applied, as a motive power, to machinery. The mode of condensing consists in placing a reservoir in the water, which shall rest on the bottom. This reservoir is to be open at bottom, to admit the water, but closed at top, to retain the air; the top is to rise to a convenient height above the line of high water; at this line there must be a horizontal partition, or diaphragm, furnished

with valves, opening upwards, to admit the air as the water rises, and to retain it in the air chamber when it falls. This chamber is to be "provided with suitable *screw valves*, to admit of using the condensed air at pleasure;" it is to be "applied like steam." "In the falling of the water, there will be a vacuum created, or a tendency to that effect, in the air chamber, or room; and the atmosphere being admitted through a valve, opening inward, will rush with a force proportionable to the base of the air room, or chamber, and thus a power will be gained, in the falling of the tide, or water, which may also be employed to condense more air, or otherwise, by making the pressure of this air to work a wheel, or piston, as it enters the air chamber."

At p. 203 we noticed a patent, obtained, about two months since, by one of the above named gentlemen, for applying the rising and falling of the tide to the propelling of machinery, and showed that the plan then proposed was old, referring to a former patent for the same thing, and our remarks thereon. Although the mode there proposed is not, we think, likely to come into extensive use, there are situations where the power obtainable might be usefully applied; but if that now brought forward is intended as an improvement thereon, we are very certain that the thing will be "mended worse." To use the condensed air to advantage, would be an undertaking of great practical difficulty, and, in the present case, could not be effected, but by a very considerable loss of power; the patentees, however, have furnished us with no plan for doing this, and we will not attack windmills. We do not know, even, what they mean by "screw valves;" these are certainly novelties in mechanics. There is no point more clearly ruled than that a patent cannot be sustained for a principle, but only for the carrying of a principle into effect by certain means; but, in the case before us, no means are given.

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22. For a *Washing Machine;* John O. Geer, Norwich, Connecticut, October 10.

A cylinder is to revolve, like a barrel churn; numerous pins, about an inch in length, are to project from the inner surface of it, and a number of round rods are to extend from head to head, within the cylinder, at such a distance from the surface as to allow water to pass. There are also rollers turning on pivots, to be similarly located. "The pins, rods, or rounds, and the roller above described, are claimed as the special property of the patentee." We do not think it worth while to dispute this claim.

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23. For a *Machine for Making Staves;* George Pack, Sullivan, Madison county, New York, October 10.

This machine, it appears, is intended only for the jointing of staves, after they have been otherwise prepared, which jointing is to be effected by a long knife, reaching from end to end. The staves are to be first boiled, or steamed, to render them tender; they are then placed between jaws, embracing their ends, and advanced under the knife by a horizontal sliding table, moved by a rack and feed hand; the knife is to be forced down by lifters, operating under one end of a lever, to which it is attached.

The claim is to "the formation of staves from steamed, or boiled, wood, cut with an edge tool, or knife, after the manner, and according to the combination, above set forth," &c.

24. For improvements in *Constructing Rail-roads, and Regulating Cars thereon;* Roswell Bourne, Lancaster, Worcester county, Massachusetts, October 10.

A want of knowledge of what has been heretofore done in the construction of rail-roads, and also of the causes of the difficulties which it is proposed to obviate, are manifested in the specification of this patent. It is proposed to raise the outer rail on a curved rail-road, so as that "the inclination inward, or centripetal force, shall govern, or render equal, the centrifugal force, and thereby prevent the great friction of the outer wheel against the outer rail, which endangers the breaking of the axle, or wheel; your petitioner thus proposes to do away with the impediment, by graduation of the elevation of the outer rail to the angle [?] of the curve, and enabling the cars to maintain the same velocity of motion, as when moving in a direct course."

Rails have been elevated in the manner proposed, long since, for the purpose of lessening the friction of the flanch against it; but more effectual modes than this, founded upon more just principles, have been adopted, as will be seen by reference to James' patent, vol. iv., first series, page 317; Wright's patents, p. 270; and Stimpson's patents, pp. 269 and 278 of this volume.

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25. For a *Gravitation Churn;* Asahel Bacon, Windsor, Broome county, New York, October 10.

There is to be a weight wound up as a maintaining power to a pendulum, a train of wheels and pinions to regulate the same, and there is a claim to "the propelling of vibrating or dasher churns, by means of a weight, or weights attached to a gearing of cog, belt or band wheels, or all of them."

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26. For a *Rotary Steam-Engine;* Arnold Buffum, city of Philadelphia, October 10.

A cylinder twelve inches in diameter, and five inches deep, is to be made of metal. An oval block, twelve inches long, six wide, and four deep, or thick, is to be placed within the cylinder and two circular heads, half an inch thick, and exactly fitting the cylinder, are to be firmly attached to the oval block; an iron shaft passing through the centre, allows the block and heads to revolve. Two valves, each four inches square, are to be hinged on opposite sides of the cylinder, in which there are recesses to receive them, they being curved to adapt themselves thereto. The steam enters the chamber by opening against the centres of these valves, so that when they are closed by the passing of the oval block, no steam is admitted, but they are forced open by it as soon as the block ceases to press on them; there are, of course, two openings, properly situated, for the escape of the steam.

Those acquainted with the subject will at once see that the operation of this engine is dependent upon principles often employed in similar machines; in the arrangement we see nothing which is likely to render it superior to others of the same class, or to remove the objections generally existing against rotary engines. The claim comprehends the whole arrangement by which the machine is characterized.

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27. For a *Doffer*, for carding machines; S. Parkhurst, Providence, Rhode Island, October 10. (See specification.)

28. For an improvement in the mode of constructing *Grates, or Grate Bars, for Furnaces;* Jordan L. Mott, city of New York, October 14.

This patent is taken for a convenient mode of constructing grate bars, so that they may vibrate and tilt readily when required, and in such a manner that they require no filing, or other fitting, but are ready for use as they are delivered from the mould in casting.

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29. For an improvement in the manner of *Constructing Roads;* Thomas Earl, Burlington, Burlington county, New Jersey, October 14.

The road is to be levelled, then covered with gravel to the depth of two inches, and upon this tar is to be poured regularly; sand is to be spread over the tar, and allowed to remain until it is perfectly incorporated; in some cases the gravel may be omitted.

We have several times mentioned a like mode of making roads in this journal, and for years before its publication have pointed it out, and advocated it; the files of the patent office may be resorted to, to show that the present patentee is not the first inventor. To us it was suggested by the accidental staving of two barrels of tar on a common road, about twenty years ago; the place is a great thoroughfare on the main mail route through the United States, and we believe that the spot now remains apparently unimpressed by the passage of thousands of heavy vehicles.

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30. For an improvement in *Cast Iron Window Sashes;* James S. Stoddard, Macedon, Wayne county, New York, October 14.

The improvement claimed consists in casting the stiles, and top and bottom rails hollow, by which improvement the muntins and uprights are preserved from cracking in the cooling of the metal.

The foregoing claim may be good, but we doubt it. Cast iron sash have been extensively used in England for many years, and it would be strange if for the purpose above named, and that of lightness, the stiles and rails had not been cast hollow, or so narrow as to give them the same substance with the muntins; had we made a pattern for casting sash, we should not have needed instruction or admonition on this point.

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31. For improvement in the *Transhipment of Merchandise, on Canal and Rail Road Lines;* James O. Conner, city of Philadelphia, October 14.

This improvement consists in the construction of water-tight boxes, capable of holding about three tons of ordinary freight, and so shaped that they shall fit into canal boats, and also form the bodies of cars for transportation on rail roads. The boxes are to be lifted from one vehicle to the other, at the places of transhipment, by means of powerful cranes.

The claim is to "the principle of using large boxes, or car bodies, fitted to the interior of open canal boats, which boxes are to contain goods, or merchandise, for transhipment on rail roads, and on canals, without separating the contents of the boxes, or car-bodies."

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32. For improvements in *Hanging Carriage Bodies;* Henry Pace, Senr., Cincinnati, Hamilton county, Ohio, October 14.

Various modes are described of carrying into effect the proposed plan, of

hanging the bodies of carriages, the description of them being given at great length, the following constitutes the claim.

"*First.* To attach as many props and levers, of the denomination of 'the lever of the first kind,' as may be required for the use of any vehicle, or carriage, drawn or propelled by animal, steam, or other power. One prop for each lever may be fixed on any part of the running gear of the carriage that may suit its use or form, the lever to work free; the fulcrum to be placed at any part of the lever between the weight and the power, at the option of the builder.

Secondly. To attach one or more springs, or other applicable power, to each lever, one end of each spring, or springs, to be affixed either to the bottom of the body, or bed, or to the running gear; and the other end of each spring, or springs, or other power, to be attached to the end of the long arm of the lever so as to work free, or to the running gear.

"*Thirdly.* To attach the ends of the short arms of all the levers to the body shackles, or to the body, or carriage, (which is the weight) so that the levers and springs may work free when the carriage is in motion."

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33. For a *Turning Lathe, to turn Rake Staves, Hoe Handles, &c.* James Haven, Newport, Sullivan county, New Hampshire, October 14.

If there is any thing really new in this lathe, the patentee has not enabled us to discover it; the object proposed, that of varying the form of the handle, or other article turned, according to a pattern, is a thing well known. The specification, without the aid of a good drawing, is insufficient for the intended purpose; and that which is called a drawing serves only to "make darkness visible." At all events, a lathe which would turn such handles most perfectly, may be constructed without violating the rights of any one.

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34. For *Running Gears for Rail Roads;* George W. Cleveland, city of Baltimore, October 14.

The object of this invention is to admit of the vibration of the axles of the wheels, in such a manner as that the latter shall always conform themselves to the curvature of the road. Each wheel has its distinct axis, there being a centre pivot to sustain the end of each, which inner ends revolve in a vibrating bar, allowing the axis to vibrate horizontally. The outer ends of the axles run in bearings which conform themselves to the motion of the inner ends of the axles. The tread of the wheels is to be perfectly flat, without any cone, or rise, towards the flanches, and it appears that the wheels are to conform themselves to the direction of the rail by the action of the flanches upon them; a very short time will, we apprehend; demonstrate the worthlessness of this plan.

The particular construction of the parts require the drawing for a proper explanation of them. Upon these the claims are founded, and are also made to any other way in which "they may be constructed, so that by means of the same principles of action, the vibration of the semi-axles at their inner bearings, may be caused and regulated, so as to preserve the parallelism of the wheels, and permit them, by means of their flanches, to conform to the course of the rail-way."

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35. For a *Stove for Burning Anthracite Coal;* Dennison Olmsted, New Haven, Connecticut; first patented, November 5, 1834; patent surrendered, and reissued, October 14.

The original specification of this patent is given at page 407, vol. XV; all that is further required, therefore, are the claims as now made, which are, 1st. Bringing the surfaces destined to absorb the heat, and transmit it to the apartment, so near each other, as to cause the heated volume of products from the chamber of combustion to come more closely into contact with said surfaces than has heretofore been done in structures more or less resembling this. 2d. Introducing into the apartment a continual current of warm air, by means of the air pipe, which admits cold air into the hollow space within the inner figure of the radiator; and this volume of air being rarified by heat within said space, that is, chiefly by circulating on the surface of said inner figure, flows out above, and is thus communicated to the apartment. 3d. Employing partitions, as before described, by means of which the said heated volume is made more effectually to traverse the absorbing surfaces.

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36. For *Gimblets;* Orville B. Percival, East Haddam, Connecticut, October 14,

In this gimblet the pod is extended down to the end, or point of the screw, so that the threads are entirely on the back of it, the screw part itself forming a cutting edge, by which means it enters more easily into the wood, turns more freely, and with less than the ordinary tendency to split the stuff. Augurs, it is said, may be constructed on the same principle. From the specimen we have seen, we think that this gimblet possesses all the good properties ascribed to it.

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37. For a *Washing Machine;* Henry Ault, Philadelphia, Monroe county, Tennessee, October 14.

A fluted cylinder is to revolve in a trough, and between this and rollers below it, the clothes are to be passed, by turning the cylinder, the gudgeons of the latter resting upon springs, and being drawn down by placing the foot upon a treadle. After they are cleaned, the clothes are to be pressed by passing them between rollers, the uppermost of which, also, may be borne down by means of a treadle.

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38. For an improvement in *Fire Arms;* Samuel Ladd, Waltham, Middlesex county, Massachusetts, October 14.

This improvement consists in "overlaying fire arms with tin, or some compound metal of a similar nature, and thereby preventing the same from corroding with rust."

We do not believe that this process will ever come into general use, as the bright surface of the tin would be more objectionable than that of iron, which it has been found desirable to remove by bronzing.

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39. For a Machine for *Cutting Felloes for Wheels;* John S. Brown, and Jacob J. Barker, Phillips, Somerset county, Maine, October 14.

We are told that this patent is taken for improvements upon a patented machine, of which the above named applicants do not claim to be the inventors. The original machine is fully described, but nothing is said respecting who invented it. The felloes are to be cut from plank by cutters projecting from the face of a segment wheel. The whole arrangement of the apparatus is given with sufficient clearness, but there is no summary of the things claimed as novelties. The right of the present patentees must rest, if they have any, upon their having become the possessors of the

original patent, of which we know nothing. The improvements being matters of mere detail.

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40. For a *Burr Stone Coffee Mill;* David Richmond, McArthurstown, Athens county, Ohio, October 14.

The claim is to "the making the bed and runner, in mills, of burr, or other stone, instead of iron, for grinding coffee, pepper and spices." We are satisfied with iron and steel, and doubt very much our ever seeing reason for changing them for stone in our coffee-mill.

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41. For a *Machine for Cutting Felloes;* Winslow, Braley and Melzar L. Worthley, Phillips, Somerset county, Maine, October 14.

The machine here described is like that mentioned at No. 39, and we learn at the Patent Office that it is the one alluded to in that article. The only difference in them is in the mode of holding the timber to be operated upon, which Messrs. Brown and Barker think they have improved.

The patentees have not made any claim; we think, however, that there is sufficient novelty in the machine, upon which to found one.

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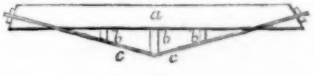
42. For *Bridges and Viaducts;* Richard T. L. Witty, Lowell, Middlesex county, Massachusetts, October 14.

We really do not understand what is meant in certain parts of the specification of this bridge; but we will afford a chance of doing so to others, by giving the whole substance of it. "I combine the lateral thrust or pressure of a beam to the catenary curve, which said curve may be formed of rods, wrought iron or other metal, and of chain or rope, &c. But I prefer rods of wrought iron. The curve of iron must be stretched from end to end of a beam of wood, and firmly bolted thereto, and passing over stauncheons or other supports of wood or iron fastened to the beam, which said supports may be placed at suitable distances under the beam to form the catenarian curve, and the more firmly to retain it in its place. By this arrangement a very considerable strength of beam may be obtained for the making of bridges over rivers, canals, &c. and for the formation of viaducts to carry over rail-ways, in the construction of piers for docks or harbours, and for public buildings where considerable extent of beam may be required."

What is claimed are the invention, improvements, or methods, of making beams sufficiently strong for the formation of bridges, so as to extend them over rivers of great width, &c. and by heading the said beams with iron shields for that purpose, and to hold firmly the iron rods.

In the drawings, the *catenarian curve* is a straight beam, the *lateral thrust* of which is to be employed by the patentee; the accompanying sketch exhibits the manner of trussing a beam to form the said catenarian curve, as the patentee calls it. *a*, the beam, *b b*, the stauncheons, *c c*, the iron rod.



43. For a *Spark Suppresser;* Haut C. Wiatt, Weldon, Halifax county, North Carolina, October 15.

This apparatus is to be used on locomotive or other steam engines. It consists principally of two tubes, one covering the other, and exceeding it in diameter about four inches; the inner tube is the chimney, the space between it and the outer is the reservoir into which the sparks are to fall; the outer tube is to have a cap with small perforations, allowing the smoke to escape, but detaining the sparks. The outer tube is made to raise and lower by means of a lever, for passing under bridges, &c. The claim is to this general construction.

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44. For a *Cooking-Stove;* Horatio B. Wade, Cincinnati, Ohio, October 17.

The claim made is to "the manner of forming a fire chamber in a permanent and fixed situation, extending from one end to the other of the stove: and the application of the movable hearth to the door thereof, being an improvement upon the stove heretofore patented; having a movable fire chest, and without any hearth.

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45. For improvement in *Anthracite Coal Stoves and Grates.* Patented October 25, 1832. Patent surrendered and reissued under an amended specification. Eliphalet Nott, Schenectady, New York, October 17th, 1835.

This stove was noticed, when first patented, at page 233, vol. XI, and to this notice we refer the reader, not deeming it requisite to make any remarks in addition to those there offered.

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46. For *Preparing Skins for Tanning;* John C. F. Saloman, Reading, Berks county, Pennsylvania, October 17.

Instead of applying dung, after the skins have been limed to remove the hair, some diluted or weakened acid is to be used "in about the following proportions. To every ten gallons of water add two and a half ounces of concentrated acid. The skins are then immersed in this diluted acid, and occasionally taken out and washed in pure water" until the lime is dissolved out.

This specification is defective in not pointing out the kind of acid to be employed, as this is a point of no mean importance; it should be one which forms a soluble salt with lime, such as the muriatic. "Two and a half ounces of a concentrated acid," is also a very loose mode of giving directions, as different acids are not equivalent to each other under equal weights. The process, we have no doubt, is a good one.

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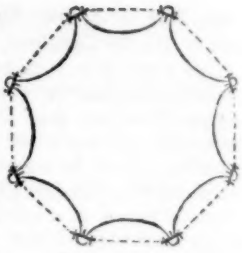
47. For a *Safety Steam-Engine Boiler;* John C. F. Saloman, Reading, Berks county, Pennsylvania, October 17.

The claim under this patent is to "the principle of constructing boilers with inverted arches, so arranged as that their convex surfaces shall resist the pressure of the steam; and the surrounding of the boiler so formed by a cylindrical or polygonal casing, forming a chord to each arch the whole length of the boiler, and thus preventing the spring of the said arches; whilst at the same time the spaces between the cases and the arches thus formed, may serve as fire-places and flues for generating and conducting heat."



The sketch in the margin shows a transverse section of the boiler. Not only is the body of the boiler to consist of arched segments, rivetted together at their edges, but the heads also are to be concave inwards, so as to be pressed on by the steam in the manner of a dome.

Such a boiler would have a much less capacity in proportion to its weight, than one of the cylindrical form, and there would scarcely be a single point within it which, by yielding to the internal force, when not sufficient to rupture it, would not thereby enlarge its capacity.

The arched form, in a malleable, flexible substance, such as iron, will not operate in the same way with the stones in an arch of masonry; every indentation in the metal is a commencing point at which it may give way, and be followed by all the parts which surround it. Besides this, we see not how the places of juncture exposed to the action of the fire, and the metal forming the chord of the arches thus exposed, are to be kept from heating, and burning out. The thing at first view, is specious in its appearance, but it will not stand the test of examination; or the searching one of fire.

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48. For a *Plough;* Junius S. Tefft, Amherst, Erie county, New York, October 17.

The claims are to "the manner of constructing and using the standard; of applying the landside plate, and the general combination of the parts."

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49. For a *Washing Machine;* Isaac Spicer, Norwich, New London county, Connecticut, October 17.

A square box is to be made to revolve upon gudgeons; in a trough, within this box, there are to be pins projecting inwards; the claim is "to the construction of a machine in square."

Such square box washing machines have been long since patented, and are well known.

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50. For *Glass Knob Screws;* Orrin Newton, Pittsburgh, Pennsylvania, October 17.

We are informed that "in the manufacture of this kind of knob screws, the head is cast in a mould on to a wire headed shank, in order to secure the *cast* head more firmly on; the sample herewith sent is made of a compound of block tin and copper, but may be made of any compound that may be cast in a mould; the great advantage of this kind of screw over all others is, its being easily cleaned, and always retaining its original colour, and is more quickly made;" nothing further is said upon the subject, yet, something more is evidently required; what information "the sample herewith sent" will afford to those who see the foregoing description, or who obtain copies of it from the office, cannot be seen; there ought to have been a drawing, as this shank head, and the casting upon it, admit of drawings, in which case the law requires them.

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51. For *Cement for Cisterns;* William N. Carson and George Roberts, York, Livingston county, New York, October 17.

The following is the whole description. "Nine parts sand, three parts water-lime, one part plaster paris, and one quart muriate of soda; mix with water into a cement; to be applied to holes dug in the earth of any dimensions, for the purpose of holding water. What we claim as our invention is the addition of the plaster of paris and the muriate of soda (common salt) to the other articles."

The use of common salt, and of plaster of paris in such cements is not new, nor do we believe it to be of any use, as good hydraulic cement, made of the best water lime and sand, needs no improvement.

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52. For an improvement in the *Machine for making Biscuit and Crackers;* Thomas Havener, and Thomas H. Havener, city of Washington, October 17.

This machine differs in a very trifling degree from others before used for the same purpose; the dough is to be rolled out between two metallic or wooden rollers, whence it passes on to an endless apron, carrying it under cutters and dockers worked up and down by a crank motion; the crank shaft standing above a sliding frame, or gate, to which the cutters are attached. On one end of the crank shaft there is a fly-wheel, and to this is attached a rod and feed hand, which operating upon a ratchet wheel, gives motion to the lower of the first named rollers; a toothed wheel on the axis of this roller acts upon the other parts by means of suitable gearing.

The claim is "the general construction of the above described machinery, with the arrangement of the several parts as described, but *particularly* the before described *ratchet or feeding wheel*, and *hand*, worked from the axis of the fly-wheel;" which claim is certainly much broader than the invention, the general construction, as before remarked, not being new; the part *particularly* claimed is a well known mode of communicating motion in machinery, and standing alone, is entirely without novelty, yet like other known modes of communicating motion, it might derive the requisite character by its making a part of a new invention.

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53. For an improvement in *Calendering Cloth;* Zenas Bliss Johnston, Providence county, Rhode Island, October 17.

The improvement here patented consists in the addition of a roller above the three ordinarily used in calenders, by the aid of which additional roller the cloth is twice glazed in its passage between the rollers, thereby preventing the necessity of performing the operation a second time. In the ordinary calender, it is said that the boxes in which the gudgeons of the top roller run, last generally but sixty days, the weight having to be applied on them, whilst by the new arrangement, in which a large roller with a slow motion receives the weight, the boxes will last for two years.

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54. For *Covering Buildings with Metallic Plates;* Phineas Burgess, Brooklyn, New York, October 17.

"The principle of this improvement consists in the lapping of the sides of the strips together with lap string pieces, with or without ribs, substantially as described." Were we to give the whole description, it would not afford a clear idea of the mode adopted by the patentee, without the aid of the drawing. We could make it intelligible by a verbal description alone, but cannot afford the space required. The object, of course, is to allow of the unobstructed expansion and construction of the metallic plates.

55. For a machine for *Cutting Crackers and Soda Biscuits;* William R. Nivins, city of New York, October 17.

An upright frame sustains the cutter which is to be worked up and down by the action of a descending weight, operating by means of a rope and pulleys, with a regulating wheel like that used in the common English roasting jack, all which is well enough shown. The patentee informs us that what he claims "is the movement of said machine, being entirely different from any other hitherto known."

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56. For a *Machine for Cleaning Feathers;* George Reynolds, East Hartford, Connecticut, patented February 17th, 1834; patent surrendered and reissued, October 17th.

We described this machine in due course, page 176, vol. XIV. The object of the surrender was to make a claim, a thing entirely omitted in the first patent; it is as follows. "I do not claim, as my invention, the cylinder, the shaft, the pins, or indeed any several part of the machine taken by itself; but I do claim as my invention the combination of the several parts of the machine as described, and applicable to the particular objects aforesaid, and the manner of communicating the heat to the feathers by means of the revolving of the cylinder, presenting every side to the fire in rotation, and communicating the heat to every part of the feathers, as they are kept continually in motion by the dressing pins and revolving of the cylinder, and not liable to burn, or be overheated by continuing too long in one position."

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57. For a *Planing Machine;* Reid R. Throckmorton, city of New York, October 22.

This planing machine is very much like that patented by the same person, on the 6th of October, see No. 4. A segment of a circle is to be suspended above the platform on which the board to be planed lies; from the face of the segment project four knives or cutters, the plank resting upon an iron bed, and being carried forward between rollers. The pendulous segment is to be made to vibrate backwards and forwards by a crank, and shackle bar. The claim is to "the peculiar construction of the plane and side cutters, moved by slides or guides and cranks, and resulting in a combined motion, reciprocating, rectilinear, and partly circular, in one operation, by connecting the end of the plane; by means of its handle, to a crank, or any other circular motion." The side cutters mentioned are, as in the former patent, for jointing, tongueing and grooving, and are to act like the upper segment. The remarks which we made upon the former patent, we should be disposed to reiterate, with the exception of acknowledging a little more clearness in the details, in the new specification. The present ought to have been taken for an improvement on the former: as it is, the two are essentially for the same thing, and both cannot stand.

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58. For an improvement in the *Art of making Bricks and Tiles;* Benton P. Coston, Sterling, Wayne county, Pennsylvania, October 22.

This patent is not obtained, as the title indicates, for an improvement in the art of making bricks and tiles, but is for a machine for mixing, moulding, pressing and delivering bricks. The description, like the machine, is rather complex; the drawing is referred to throughout; a number of individual claims are made; and to these is added a claim to the general ar-

rangement and combination. A copy of those claims would not be understood without the drawings, it would show, however, that they are not very limited in their character.

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59. For a *Circumferenter, or Surveyor's Compass*; Samuel R. Miller, Port Royal, Frederick county, Virginia, October 22.

The claim made is to "an improvement on Francis Whitelly's compass, and consists in the arrangement of the several parts of the instrument described for taking angles."

The description is very imperfect, and the claim omits entirely to tell in what the improvement consists, an omission which, from the demands of the law, must be fatal. Who the Mr. W. is, whose compass has been improved, we do not know. It appears, however, from the specification and drawing, that the instrument here patented has a graduated semicircle, furnished with sights fixed upon arms on the chord of the semicircle produced. The needle is on a fixed arm, which is pointed, the point lying on the graduations of the semicircle, which latter, of course, moves with the sights, the degrees being read off at the point of the fixed arm.

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60. For an improvement in the *Manufacture of Tubes and Hinges*; William Shaw, Buffalo, Erie county, New York, October 27.

The machine intended to be described is one for bending sheet metal to form the tubular knuckles of hinges; the description is a very imperfect one, and there is not any claim made; we think, however, so far as the materials before us will justify an opinion, that the machine is sufficiently original to be claimed as a whole. The sheet metal is to be passed in between two blocks of steel, and held in its place by a tightening screw; when, by turning a crank, the end of it is bent round a pin, which pin is to be pushed out by placing the hand upon a lever, thus forcing up a round punch, or wire, for that purpose.

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61. For a *Morticing and Tenoning Machine*; John McClintoc, Chambersburg, Franklin county, Pennsylvania; patented October 8th, 1827; surrendered and reissued October 27.

The original patent was without any claim; it, however, described several things which have been claimed by others in patents subsequently obtained. We cannot now institute an enquiry into the originality of this and the other numerous morticing machines which have been patented at various times. The present claims are to the construction of the part which holds the chisel; the manner in which it is worked; the rack and pinion, that is the chisel rack and wheel; the mode of reversing the face of the chisel; the sliding table for bringing the pieces to be wrought into the proper place, the box which holds the stuff, and the manner of moving it; the round tongue on the chisel; the cutting sockets for Venitian shutters; the four-sided chisel; the double-cutting chisel; the treble-cutting chisel; the two-faced chisel; and the operating by treadle and spring.

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62. For *Obtaining a Power for Propelling Cars, Boats, &c.*; Alexander M'Grew, Cincinnati, Ohio, October 27. (See specification.)

63. For a *Machine for Sawing Stone;* Daniel Bunnel, Zenia, Greene county, Ohio, October 27.

Saws are to be strained on frames, and fixed so as to run with a carriage having wheels upon suitable ways. The frames are to be moved by a crank motion. We are sorry that the patentee has omitted to tell what he claims, as we are entirely at a loss on this point, the whole, so far as we can perceive, being quite old.

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64. For an *Apparatus for Boiling Sugar under a vacuum;* John Steele, Jr., city of New York, October 27. (See specification.)

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65. For an improvement in the *Stone coal Stove;* Philip Benedict, Lancaster, Lancaster county, Pennsylvania, October 27.

This patent is said to be for an improvement on that of February 27th, 1830, noticed at p. 306, vol. v. The specification of the original patent was very obscure, and the present one is equally liable to the same objection; there is no other claim made than what is comprised in the information, that "the improvement consists in the lower oven, and manner of fixing the cylinder," neither of which are clearly described.

66- For *Ovens;* Jacob Baldwin, city of New York, October 27.

This patent is obtained for what must be esteemed a magnificent affair, as not only are ovens to be heated by anthracite coal, but, by means of the heated air, or *gas*, arising therefrom, houses and hotels, of the largest size, are to be warmed and *lighted*. "The inventor believes that the general use and application of his improvement will save our large cities from the repeated and heavy losses by fire, which from time to time occur;" and most assuredly he is correct in the conclusion, that, if they make all their fires by burning anthracite, in ovens of stone, or brick, and use no other light than that obtained from the gas arising from it, there will be little danger from the fire, and none from the lamps. The oven is to be built like a common bakers' oven; in one corner of it there is to be a grate, upon which the coal is to be laid and ignited, there being a draught hole beneath it. A flue, furnished with a damper, is to carry off the gas, which may be conducted wherever it is required for heating, or *illumination*. Upon these points there are, most unfortunately, no directions given, and we fear, therefore, that those who attempt to carry the plan into operation, especially the latter part of it, will *grope their way in the dark*. There is not any claim made.

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67. For *Cutting Boots, Bootees, and High Laced Shoes;* Josiah T. Buck, New Canaan, Fairfield county, Connecticut, October 27.

We think that it will require a "cunning workman" to cut uppers for boots, &c., according to the proposed plan, without further directions than those given in the specification; all of which is comprised in the information, that the measure of the foot and leg are to taken in the mode now practised, the measure is to be laid on the leather, or cloth, to be cut; "when the upper for a boot is cut, it is but one piece of leather, with a slit on the vamp, and a projection for the top of the boot, making but one seam to close, and that a circular seam, running near the fore part of the boot, and ending at the bottom of the vamp, near the counter." There is neither a claim, nor drawing.

68. For a *Horse Collar Machine;* Caleb Angevine, city of New York, October 27.

The machine described is for blocking horse collars, a purpose for which several patents have been obtained within a year or two. A block, in the proper form, is to be bolted on to a bench, and a rope, passing round the collar, draws it to the block, said rope being wound round an iron shaft, turned by a wheel and pinion at one end of the bench. The patentee claims "the application of the cog wheels, cylinders, or shafts, hand crank, bolting the collar on the bench, hand lever, rag wheel, and stop, or catch, all as set forth in the specification." He probably might have extended his claim to the pair of hands by which he turns the crank of the pinion wheels.

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69. For *Moulds for Loaf Sugar, &c.;* Charles Duncan, Williamsburg, Kings county, New York, October 27.

A concave mould, or chuck, is to be made, and fixed upon a vertical shaft, which is to revolve like a potters' wheel. It is proposed to form the inside of this mould, or chuck, of plaster of Paris. The prepared clay for making the sugar mould, is to be laid within the concave, and a *former*, of the shape of the inside of the mould, is to be made to descend within it, so as to shape and smooth it. The specification, though verbose and involved, may, nevertheless, be sufficiently well understood to enable a person to carry the plan into operation. There is no claim.

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70. For a *Machine for Propelling Machinery;* David Russell, Tuscumbia, Franklin county, Alabama, October 27.

This is called "Russell's Power Motion Machine," and we suppose that it is intended to gain power, in some way, but how, we are not told, and cannot discover. A circular platform of wood, which is a flat ring, two feet wide, twenty in diameter, and four inches thick, rests upon steel springs; upon this platform, a heavy wheel is to roll, having a horizontal shaft geared into a vertical centre shaft, in the manner of some bark, drug, and other mills. The magic is, no doubt, in the springs, but we have no seer by us to unbind the spell.

The *combination and arrangement* are claimed, and we are told that "this machine may be used to propel all kinds of machinery, and may be propelled by steam, horse, water, or manual power."

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71. For a *Portable Saw Mill;* David Russell, Tuscumbia, Franklin county, Alabama, October 27.

Strange as it may seem, this portable saw mill, although invented by the patentee of the *machine for propelling machinery*, is to be driven by a horse, geared to a shaft, in the usual way. A frame is made, which is to be moved about upon wheels, and is to sustain the various parts of the mill, which has nothing peculiar in its construction, excepting it be that the saw is not to be strained in a frame, but the upper end of it is to be acted upon by springs, which are to aid in raising it, in conjunction with the operation of the crank at its lower end. Respecting the use of springs, we refer to No. 8, p. 327; this application of springs is not claimed, nor, indeed, is any thing, excepting "the combination and arrangement of the several parts," which, when there is no novelty, is a convenient mode of slurring the matter over.

72. For an improvement in the *Gearing of Rail-road Carriages;* William T. James, city of New York, October 27.

The claim made will explain the object of this invention; it is as follows. "The application of wheels to rail-road carriages, by separate frames, in such a manner that they will traverse such segments of a circle as is required to conform to the curves of the road; the centre of which circle being placed on that part of the frame towards the centre of the carriage." Arrangements very similar to this have been the subject of previous patents, and as applied to two separate carriages of four wheels each, is in use in Winans' patented double cars, on the Baltimore and Ohio rail-road.

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73. For a *Cooking Draw:* John C. Howard, Howard's Valley, Windham county, Connecticut, October 27.

A flat grate is to be set into a fireplace, and over this there is to be a drawer of metal, to slide in and out upon proper guides, or ledges. The claim "is a draw passing on grates into the chimney back, boiling and baking with the ordinary fire." The articles to be baked, boiled, or otherwise cooked, are to be put into this "draw."

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74. For a *Cotton Whipper;* Lucian Osgood, Pomfret, Windham county, Connecticut, October 27.

"What I claim as my improvement, and by which the whipping machine for cotton is facilitated, and rendered more effective than heretofore, is the placing the whip shafts of such machines obliquely, so as to form an angle with the horizon, of twenty-five, or such other number of degrees as may be preferred."

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75. For an improvement in the *Machine for Hulling Cotton Seed;* Anderson Miller, Washington county, Mississippi, and Thomas Laws, Jefferson county, Kentucky, October 27.

This machine is said to be an improvement upon that of Follet & Smith, but the whole arrangement of it is described, without any attempt being made to distinguish between the improvements, and the original machine. Much stress is laid upon the frame being of cast-iron, the gudgeons running in brass boxes, and all the parts of the machine being firmly made; there is also an eccentric roller described, by turning which the feed can be regulated. It should be recollected by the patentees, and by the purchasers of machines, or rights, that, excepting under the authority of Messrs. Follet & Smith, there can be no valid conveyance of the improved machine, any more than there can be of my house by a tenant, because he has improved it.

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76. For an improvement in *Making Ploughshares and Coulters;* Samuel A. Sperry, Ann Arbor, Washtenaw county, Michigan, October 27.

The iron is to be rolled, as nearly as may be, into the proper shape; it is then to be converted into steel, and the shares, or coulters, are afterwards to be forged into such forms as may be wanted. The right to do this is claimed, which claim is one of a very questionable character.

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77. For *Fastening Drawers;* Edward Brown, Lynchburg, Campbell county, Virginia, October 28.

We, some four or five years since, noticed a patent for a method of fastening a tier, or case of drawers, by one single lock, and mentioned a similar plan, by which we had, many years ago, effected the same object; the idea of doing so, however, we derived from a nest of drawers, imported from England; the plan now patented differs from those alluded to, but it is less simple, and not more efficacious. A rod is to extend up from the bottom to the top of the case, in a groove in one of its ends; this rod turns on pivots, and has a number of leaves projecting from it, equal to the number of drawers; when the drawer which has the lock on it is pushed in, it turns this rod, and brings the leaves to bear on recesses, or holes, in the sides of each of the other drawers. The claim is to the manner described of effecting this object.

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78. For an improvement in the "*Circular Revolving Tenter Bars;*" Stephen R. Parkhurst, Worcester, Worcester county, Massachusetts, October 28.

We described the circular tenter bars at p. 19, vol. xvi., and the present patent is obtained for improvements thereon; these consist, mainly, in those arrangements which were deemed best adapted to the employment of steam to facilitate the operation of drying the cloth. The cloth, instead of being wound spirally, is coiled round upon circular tenter bars, usually forming three thicknesses from a whole piece. The circular tenter bars have heads to them, which enclose the apparatus, excepting at the centre, and the cloth, when wound, forms the periphery of a drum. Steam is admitted into the apparatus through a hollow axis, and circulates around wheels, the rims of which are hollow tubes, and extend out nearly in contact with the cloth, thus heating the air within the drum. Vanes, to agitate the warmed air, are placed within the drum, and a rapid revolving motion being given to the apparatus, the air is driven through the cloth, and it is quickly dried. The claims made embrace the new arrangement of the machinne.

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79. For a *Planing Machine;* Ira M'Laughlin, and Hiram Hill, Sunderland, Bennington county, Vermont, October 28.

We shall not attempt to explain the particular devices adopted by the patentees for giving motion to the different parts of the machinery, (and to which their claims are confined,) as the whole apparatus appears to us to be very inferior to several others for the same purpose. The planing is to be effected by a plane of the ordinary construction, and the stuff to be planed, together with the bench on which it lies, are to have a reciprocating motion, the plane being at rest. There, manifestly, must be an enormous waste of power, in thus moving the heavier body backward and forward, instead of the lighter.

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80. For a *Portable Stave Dresser;* Joseph Sweet, Murray, Lycoming county, Pennsylvania, October 28.

This patent appears to be taken for an improvement upon some other stave machinery, but what other we are not told. The staves are to be forced between knives, by means of followers, which have a toothed rack upon them, and are acted upon by a pinion. The knives are concave and convex, so as to dress each side of the stave, and as one follower rises, another descends, there being two sets of knives, or cutters. The claim made is to "the additional follower, and the mode of securing the guides." The

forcing of staves between such knives, by similar means, is not new, nor is it claimed. If there is an existing right to the original machine, the improvement must be used in subservience thereto; we think it probable, however, that it is common property, as such knives have been long used.

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81. For a machine for *Crushing and Grinding Corn;* Anderson P. H. Jordan, Madisonville, Monroe county, Tennesse, October 28.

The crushing is to be effected by a twisted bar of wrought iron, operating like that described by Oliver Evans, as used in mills for grinding plaster of Paris; from this twisted bar, the corn is to pass between a conical nut and shell, of the ordinary form. "The improvement consists in the uniting of the nut to the twisted bar, and upon this union the patent is claimed;" a union which may very well be dispensed with.

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82. For a *Cement for Forming Pillars, Plastering Houses, &c.;* Charles Clinton, Minnisink, Orange county, New York, October 28.

Limestone is to be burnt until about two-fifths of it is converted into lime; to four bushels of this, when cool, four pounds of pearl-ash, and three pounds of alum, are to be added, and the whole ground fine; the composition is to be put into open barrels, and to remain there until the lime is perfectly slacked, after which it is to be mixed with water to a proper consistence, and used as a hard finish for walls; when rubbed down, it is to look like polished marble. For outside walls, about one-third part of sand is to be added. The composition may be variegated in its colours by the addition of proper materials for that purpose, and a variety of modes are suggested for varying the ornamental appearance of it. "Blocks, pillars, &c., may be formed of the cement, and, when sufficiently dry, may be plastered as before directed, and polished." Such are the general directions given, together with several variations, which we do not think it necessary to notice, as no claim whatever is made.

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83. For a *Horse Power;* Asa Trahern, Henry Heberling, William E. Lukens, and John Heberling, Short Creek, Harrison county, Ohio, October 28.

This horse power is of the well known kind in which the animal, walking in a circle, is geared to a lever extending from a vertical shaft; at the lower end of this shaft is a crown, or bevil, master wheel, gearing into a pinion, or wallower, on a horizontal shaft, even with the ground. We cannot find any thing new in the affair; but the patentees claim "the eye of the master wheel and shaft, and the moving pinion, by which means, wood, pot metal, and iron, and, consequently, cost, are saved, and its utility greatly increased, whilst it is rendered much more portable." We are told that the master wheel "has a round eye, and runs on a round shaft." And the pinion by which the power is communicated at the outer end of a horizontal shaft, runs in a frame which may be moved round, so as to cause it to stand on any part of the periphery of the wheel which drives it. These, we suppose, are the things intended to be claimed by the four improvers of the horse power.

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84. For a *Hill Side and Horizontal Plough;* John W. Jordan, Lexington, Rockbridge county, Virginia, October 28.

The claim made is to "the *combination* and *arrangement* of the parts of the described plough, but particularly the *form* of the mould-board, and the

manner of reversing it, though no claim is made to the principle of revolving mould-boards." As respects "the *form* of the mould-board," it is said to resemble "two mould-boards of the M'Cormick pattern, (a right and a left hand,) united by their upper edges." There are numerous points of detail, showing, by reference to drawings, the particular manner in which the patentee constructs and connects the various parts of his plough, but nothing which bespeaks it superior to other hill-side ploughs, many of which have been patented.

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85. For a *Gridiron;* Kellogg Strong, Meriden, New Haven county, Connecticut, October 28.

This is a rotary gridiron, very much, in appearance, like those already in use, consisting, like them, of two parts, the lowermost, or stand, being used to support the rotary bars. The thing claimed in this is the making the rotary part, which supports the meat, of very narrow flat bars, which allow the gravy to run on to the bars of the stand, which are fluted, and lead to a common receptacle, or gravy cup, from which they all radiate; in consequence of this construction, we are told that the juices run freely to the reservoir, the current not being disturbed by the rotation of the upper part.

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86. For a *Machine for Cutting Saw Teeth;* Andrew F. Mervin, Muncy, Lycoming county, Pennsylvania, October 28.

The action of this machine for gumming saws, or cutting saw teeth, is so similar to that of many others, as to render it unnecessary to describe it, the main difference between them being in form only. The claims include parts which have no novelty, being to, "movable dies; the plate for holding down the female die; the screws and plate for regulating the stock; the regulator for determining the size and shape of the tooth, with the arrangement and adaptation of the several parts."

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87. For an improvement in *Pumps;* Joseph Redelsperger, Mansfield, Warren county, New Jersey, October 28.

We have frequently remarked, that when we meet with a patent for improvements in pumps, we expect but little that is valuable and new, and we are compelled to say that the one now presented to our notice does not contain any thing to exalt it above its fellows. In its general construction, it is a common double-barrelled forcing pump, the parts of which do not offer any thing new, excepting it be two or three complex modes of working the pistons, which will ensure an abundant portion of friction. The claims made extend only to "the combination and arrangement of the several parts of the pumps, as above described;" and which combination and arrangement, were we about to erect forcing pumps, we would most carefully eschew.

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88. For a *Rotary Pump;* Charles Peters, and Benjamin Deane, Poughkeepsie, Dutchess county, New York, October 31.

This rotary pump varies but little in its mode of action from others which have preceded it. There is to be a cylindrical case, with flat heads, and within this a smaller cylinder is to revolve, leaving an annular space between the two for the water chamber. Three valves are hinged, and shut into the inner cylinder, of which, when closed, they make a part of the periphery; they are forced into their places by a stop, or curved plane, which fills the capacity of the chamber in one point. When they pass this, they are

forced out by pins, radiating from the centre, and in contact with their under sides; the pins are operated upon by a fixed stationary cam, in the centre of the pump. The water is not to be delivered from an eduction pipe on the periphery of the outer cylinder, as is usually done, but from the centre of one of the heads; to enable it to arrive there, perforations are made through the revolving cylinder, under the valves, this cylinder being hollow, and supported by arms. This latter arrangement makes a prominent part of the claim, and, so far as we know, is new, and, the patentee thinks, very advantageous; we, however, are unable to discover whence its benefits are to be derived. An important thing in every pump is to change the direction of the water as little as possible, and certainly this is not accomplished by the mode of delivery proposed. In other respects, this pump is liable to the general objections to those on the rotary plan, resulting from the accuracy required in their construction, and which, if at first attained, is soon lost by wear.

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89. For a *Truss for Hernia;* Henry Reid, Augusta, Georgia, October 31.

We suppose, from the manner in which the application and use of this truss are described, that the patentee is a practitioner of medicine, as it displays both knowledge and judgment upon the subject to which it relates. The truss spring is, in all cases, to extend entirely round the body, and is to be furnished with two pads, one at each end, that which presses on the abdominal ring on the sound side being soft, whilst that on the ruptured side is to be of wood, adapted to the size of the patient, and in the form of a half egg, supposing it to be divided longitudinally. There is no claim made, but the patentee evidently proceeds upon the idea that springs passing round the body, and having a pad at each end, are novelties.

The patentee says that this truss "differs from Hull's and Marshe's, in the peculiar shape of the block by which the immediate pressure is made, and in the immobility of the blocks, and in the pressure being made by blocks, instead of pads, or cushions. It differs from Stagner's in having simply spring power, and that so adjusted to the parts as to retain its adjustment without the aid of belt, buckle, and straps, or any other means, except the spring power."

"What I claim as my own invention, and not previously known in the above described improved independent spring truss, is, that it passes from one abdominal ring, and maintains a permanently equable pressure on the soft parts above the brim of the pelvis on each side, without the aid of belt, strap, buckle, or any other appendages whatsoever; and I claim, also, the short curved spring passing from the groin to the umbelicus."

The patentee is in error in supposing that a truss spring passing entirely round the body, and having a pad at each end, is new; we have seen more than one of this kind; that patented by D. Weaver, of Baltimore, is described at p. 327, vol. xiii., where it is expressly stated that "the double spring is to be used whether the hernia be only on one, or on both sides; this latter truss has also two small pads near the middle of the spring, one to bear on each side of the spine; there is a hinge joint at the middle, connecting the double spring, and calculated to give extra freedom to its motion, which is, we think, a manifest advantage.

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90. For *Ladies Metallic Hair Combs;* Nathaniel Bushnell, Middletown, Middlesex county, Connecticut, October 31.

The comb described is to have the top made of tin, and the teeth of iron wire; the upper ends of the teeth are to be soldered to the plate, the edges of which are to be bent over to secure them in their places. The comb is afterwards to be painted in imitation of shell, or otherwise ornamented. Much is said about claiming and not claiming, which results, as we understand it, in there not being any thing new, excepting the manner of securing "the end teeth," which is a trifling affair, not worth describing, although worth patenting.

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91. For a *Tailors' Measure;* Frederick A. Fairchild, Columbus, Muscogee county, Georgia, October 31.

The claim made is to "the combination of the steel bands with the sheet-brass strips, by means of clasps, loops, and thumb-screws, adjustable together, and substantially as described."

The drawings of the steel bands, brass strips, and a number of graduated tapes, have a very formidable appearance, and seem sufficient to enable a surgeon to bandage every limb in a man's body. We take it for granted that the apparatus is a very perfect one, but cannot undertake to analyze it.

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92. For an improvement in the *Steelyard Balance;* Christian F. Dahl, city of Pittsburgh, Pennsylvania, October 31.

The improvements claimed consist, first, in giving the suspensions a single bearing, by allowing them to pass into a slot, or mortise, in the beam, instead of embracing it on each side; and, secondly, in placing a screw vertically at the back end of the beam, with a ball, or nut, on it, by the raising or lowering of which, the sensibility of the beam may be increased, or decreased. We are not aware that any benefit will be derived from having a single bearing for the suspensions; the patentee says that the friction will be lessened, but such is not the fact, as that will be proportioned to the load, without regard to the length of the bearing, supposing the workmanship to be good. The patentee speaks of the ball, on the vertical wire, as though it afforded the means of adjusting the beam, but its effect will be only to raise, or lower, the centre of gravity.

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93. For *Open Stoves, and Fire-places, for Warming Buildings;* Daniel Sutherland, Lisbon, Lincoln county, Maine, October 31.

This stove, or fireplace, is similar to those open stoves, from the top of which a pipe ascends, and passes into the chimney at any convenient height. In the case before us, there is to be an open and direct passage into the chimney in the ordinary way, and a pipe, or second flue, rising from the top of the stove. A valve, or sliding shutter, is so constructed that either of the flues may be closed by it, at pleasure, or both left partially open.

SPECIFICATIONS OF AMERICAN PATENTS.

Specification of a Patent for an improvement in the Rearing of Silk Worms; Granted to GAMALIEL GAY, *Poughkeepsie, Dutchess county, New York, October 6th,* 1835.

To all to whom these presents shall come, I, Gamaliel Gay, of the town of Poughkeepsie, in the county of Dutchess, and state of New York, send greeting.

The hurdles for rearing and feeding silk worms upon, are, or should be, made on a horizontal, four sided frame, of convenient width and length, and bottomed with cane, or twine, either reticulated, or having interstices between each slat of the cane, or thread of twine; which meshes, or interstices, should be of such dimensions that the silk worm will lie and feed upon them, and the litter of the worms fall through.

Now, be it known, that I, Gamaliel Gay, have invented, and applied to use, a revolving apron, for receiving upon it, and removing, the litter of the silk-worms, which falls through the hurdles, as above mentioned. The specification of which new and useful invention, for receiving and removing the litter of silk worms, is as follows.

The revolving apron for a single hurdle is constructed by placing in a frame, or otherwise, at and immediately under each end of the hurdle, a roller, or cylinder, in length equal to the width of the hurdle; over these cylinders, or rollers, extending from the outside of the periphery of the one, over and around that of the other is affixed an endless apron of cloth, or other flexible substance, equal, at least in width, to the width of the hurdle. This apron being drawn tight around the rollers, and the ends fastened together, is made to revolve around both rollers, by turning them by a crank affixed to the axle of one of them, or by otherwise revolving the rollers. The endless apron being thus constructed, receives the litter from the hurdle as it falls through, which litter, by causing a semi-revolution of the apron, is removed from under the hurdles, and caused to fall in a heap at one and either end of the hurdles, and may be suffered to fall from the apron either upon the floor, or into a vessel placed at, and partly under, the end of the hurdle, and below the outer periphery of the roller.

In case two or more hurdles be placed in tiers, one above the other, the same apron may be used, in which case an endless and separate apron is required for each hurdle; but the best method, the most convenient and least expensive form of apparatus, and which I claim as a constituent part of my invention, is constructed as follows. Let there be rollers, or cylinders, affixed under each end of each hurdle, the same as in case of a single hurdle; to one roller, below the lower hurdle, attach one end of an apron, of the kind and proportionate width first above specified; let this apron pass under the opposite roller, over the roller next immediately above that, under the roller next immediately above the first roller to which the apron is attached, over the next above roller, and under the next opposite one; and so on according to the number of hurdles in the tier, until the apron reaches the last roller to which the apron should be attached, after adding to the length of the apron at least the length of one of the hurdles, which should be rolled upon the last mentioned roller. The apron thus passing under each hurdle, receives all the litter falling from each, which litter is discharged, part at one end, and part at the other end of the hurdles, by turning the first mentioned roller so as to wind over and around it a quantity of the apron equal to the length of the above hurdle, which winding causes an equal quantity of the apron to unwind from the roller to which the other end of the roller is attached; after the litter is thus discharged from the apron, the apron is, in part, to be again wound around the upper roller, as first above mentioned, so as to remain until the litter is again discharged.

What I claim as my improvement, and wish to secure by letters patent, in the rearing of silk worms, is the application of a revolving apron, or aprons, placed under the hurdles upon which the worms are fed, for the purpose of receiving and removing the litter falling from them; and this I

claim, whether the same be made exactly in the way described, or in any other, operating substantially on the same principle, and by which a similar effect is produced.

GAMALIEL GAY.

Specification of a Patent for a Doffer for Wool Carding Machines. Granted to STEPHEN R. PARKHURST, *Providence, Rhode Island, October 10th,* 1835.

To all persons to whom these presents shall come, be it known, that I, Stephen R. Parkhurst, of Providence, in the county of Providence, and state of Rhode Island, and Providence Plantations, have invented a new and useful doffer, with corresponding rolls, for the wool card, called a finisher. Instead of a continuous cylinder, this doffer is composed of a set of wheels, or pulleys, of equal diameter with the common doffer, covered with a card in the same way, of three or four inches thickness at the rims, to revolve like the common doffer, placed upon their shaft, an inch, or an inch and a half, apart, and at a small angle and parallel with each other, and making such an angle with the shaft as that the spaces between may be fully compensated in their revolution, and the whole surface of the main cylinder be passed over by them; and their rims, or outer surfaces, must be parallel to their shaft, so as to conform to the surface of the main cylinder. Next, there is a set of pulleys, which I call division rollers; these may be about four inches in diameter, for a common doffer, of the same thickness with the spaces between the different rims, or pulleys, of the doffer, placed upon their shaft at the same angle, turned by a belt, or gear, placed before the doffer, with their shaft a little lower than the shaft of the doffer, and so placed that their outer edges will be a little within the rims of the doffer, for the purpose of keeping the wool on the different parts, or wheels, of the doffer, entirely separate, as it is taken off by the top rolls, hereinafter described. The next are a set of pulleys, or wheels, or rims, which I call the top rolls; they are equal in number to the different rims of the doffer, four or five inches in diameter; they may be a little less in thickness than the width of the different rims of the doffer, so that the division rolls may revolve freely between them, placed so as to revolve in contact with their correspondent rims of the doffer, for the purpose of taking the wool from it, and so placed as that they will so bear upon the shaft of the division rolls as to be turned by it. A comb, if necessary, may be attached to this doffer, to clear the wool from it. The wool taken from the doffer by these top rolls, kept in separate laminæ, or flakes, by the division rolls, drawn over the shaft of the division rolls, may be passed through a tube, or a belt, and then run on a spool, or spools; or, by a flyer properly placed, it may be at once twisted into a thread. By regulating the feed of the card, and the speed of the division rolls, the size of the roping, and of thread, i. e. the fineness of them, may be regulated, or adjusted, to suit the work required.

I claim as my invention, and not before known, the doffer before described, together with the top rolls, and division rolls, to correspond with it.

STEPHEN R. PARKHURST.

Specification of a Patent for Obtaining a Power for Propelling Cars, Boats, &c. Granted to ALEXANDER M'GREW, *Cincinnati, Ohio, October 25th*, 1835.

To all whom it may concern, be it known, that I, Alexander M'Grew, of Cincinnati, in the county of Hamilton, and state of Ohio, have invented, or discovered, a more economical mode of obtaining power for propelling cars upon rail-roads, boats upon rivers and canals, and effecting other objects, where such power may be wanted for the purposes of transportation, than has heretofore been adopted; and I do hereby declare that the following is a full and exact description thereof.

My improvement does not consist in the employment of any newly invented machinery, but in the using of such power from falls, or currents of water, or other natural or artificial sources of power, as has heretofore been allowed to run to waste, and employing the same for the purpose of condensing of air into suitable receivers; the elastic force of which condensed air is to be subsequently applied to the purposes herein designated. In numerous situations in the courses of canals and rail-roads, and of other roads and water courses, there are falls of water, waste weirs, dams, sluices, &c., the power from which, if economized, would be ample for the attainment of all the ends proposed by me; I bring this into use by taking the waste power from wheels, or other machinery already erected, or by erecting others where they do not already exist, using any of the known constructions of such wheels, or other machinery, as may be best adapted to the particular situations in which they are to be employed; these I connect in the ordinary way with the piston, or pistons, of condensing engines, constructed for the condensing of air, and force air thereby into suitable receptacles, or reservoirs, furnished with the requisite tubes, valves, or other appendages, by which they are adapted to the containing of the air thus condensed, and to the supplying of the same in measured quantities, so as to operate upon a piston for driving and propelling machinery, as high steam is now made to operate. The means of doing this does not require any description, being perfectly familiar to competent engineers. The air is to be condensed into one large stationary reservoir, and by means of a connecting tube and stop cock, transferred therefrom into other reservoirs connected with the vehicle to be propelled.

What I claim as my improvement in the art of propelling cars, boats, or other vehicles for transportation, is the employment of the waste power of water, wind, or other natural or artificial sources of power, to the condensation of air, in the manner, and for the purposes, hereinbefore set forth.

ALEXANDER M'GREW.

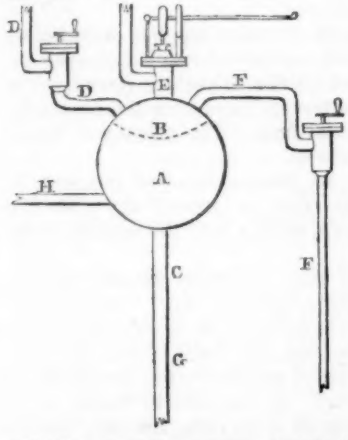
Remarks by the Editor.—It has been repeatedly proposed to drive rail-road cars, &c., by means of condensed air, instead of by steam, and to erect stationary engines for the purpose of filling the requisite reservoirs, and we believe that the thing was attempted in England. Were there not serious practical objections to the plan, it would certainly present many advantages, but these are so weighty, that they are not likely to be removed. Among them is the perpetually diminishing power of the condensed air, as every stroke of a piston must lessen its elastic force; to graduate the quantity emitted from the reservoir, in proportion to this diminished force, would be very difficult; and, besides this, there ought, when the reservoir is

renewed, to be a pressure of several atmospheres above what is required in a steam boiler, or it will soon be so far exhausted as to be inadequate to the production of the intended effect, as they would have to be exchanged whilst under a pressure of two or three atmospheres.

The present patentee does not propose to remove the foregoing, or any other objection to the use of condensed air, excepting it be the necessity of erecting stationary engines to effect the condensation; and to accomplish this, he depends upon the employment of means which would generally be more difficult, precarious, and expensive; in many places, the means of condensation proposed to be used would not be found within many miles of the stations where the reservoirs would be wanted, and there are, in fact, but few situations where the means of applying waste power would not be a costly undertaking.

Specification of a Patent for an Apparatus for Boiling Liquids under a vacuum. Granted to JOHN STEELE, Jr., *city of New York, October 31st* 1835.

To all to whom these presents shall come, be it known, that I, John Steele, Jr., of the city of New York, in the state of New York, have invented a new and useful improvement in the apparatus for boiling liquids, &c., under a vacuum, and that the following is a true and exact description thereof.



A, in the drawing hereto annexed, and to which I refer as part of this specification, is a large air-tight vessel, which may be made of any convenient shape, and of wood, or metal. B, is a colander, extending through the air-tight vessel A, in order to disperse a jet, or stream, of water into small drops, thrown in by the pipes D and F, which are constructed with proper cocks, or valves, for regulating the supply of water. E, is a safety valve. C, is a pipe of the proper length, the lower end of which is plunged in water. H, is a pipe from a steam boiler. In order to produce a vacuum, steam is let into the vessel A, through the pipe H, until the vessels are completely blown through, when the pipe H may be shut. A quantity of cold water is now thrown on the colander B, by the pipes D, or F, which instantly condenses the steam, and forms a good vacuum. The condensation water falls out at the pipe C, G. A pipe from the pan, or still, is introduced into the large vessel A, or any pipe connected with it; consequently, a vacuum is formed in the pan, or still, so connected. The pipes D and F, may be supplied with water by means of a force, or of any other, pump, or they may supply themselves, if the location be convenient.

What I claim as my invention, and not previously known, in the above described apparatus, is the boiling of sugar, or any other substance, under a vacuum, without using an air pump to produce that vacuum.

In witness whereof, I have hereunto subscribed my name, this twenty-sixth day of August, in the year one thousand eight hundred and thirty-five. JOHN STEELE, Jr.

Progress of Practical and Theoretical Mechanics and Chemistry.

Report on the use of the Hot Air Blast in iron Furnaces and Foundries.

By A. GUENYVEAU, *Engineer and Professor in the Royal School of Mines.*

[Concluded from p. 139.*]

II. APPLICATION OF THE HOT AIR BLAST TO CUPOLA FURNACES, TO SMITH'S FORGES, &c.

The hot air blast appears to have been applied with great advantage, in England, in furnaces for remelting pig iron. The consumption of coke, per ton of iron, was reduced from 400 to 280 lbs., one ton of metal passing per hour. The blast was heated by an apparatus placed at the trunnel head. There are various advantages resulting from this application. The fusion of the metal takes place in about half the time required to melt it by the cold blast; it is thus less exposed to the injurious action of the blast, and while twice the quantity of iron can be melted in a given time, the quality of the material is better. It is further stated that the quality of the iron is improved by the melting, and that it is more easily cast, owing to its greater fluidity.

At Vienne, France, there are two cupola furnaces supplied with hot air. The apparatus is at the trunnel head, and consists of two bell-shaped vessels, through the interstice between which the draught is forced. This form of apparatus is decidedly bad, the alternate expansion and contraction of the parts renders it leaky in a very short time. The efficacy of the hot air blast is felt, however, even at this furnace.

In applying the heating apparatus at the trunnel head of furnaces, for smelting lead, copper, &c. care must be taken to protect the pipes from the sulphurous and metallic vapours, which, issuing from the furnace, would destroy them very rapidly.

The fan, or rotary, blowing machine is used in several establishments at Paris, Rouen, &c. for supplying cupola furnaces with air. This though a simple means of applying power, does not seem to be an economical one. Even when great velocity is given to the fans, the force of the blast is inconsiderable, but by increasing the opening of the blast-pipe, the quantity of air thrown in may be rendered very great. In one case at Rouen, by increasing the diameter of the tuyeres from 30 to 54 lines, the daily yield of the furnace was nearly doubled, and an economy of fuel (coke) of 20 per cent. resulted, the cold blast being used in both cases. At La Voulte the fan makes from 800 to 1000 revolutions per minute, and the pressure at the tuyere is only four-tenths of an inch of mercury. Three and a half to four inches is the ordinary pressure with other blowing machines. If the air were to be heated, this machine would be hardly applicable, as the friction in the tubes of the heating apparatus would tend materially to diminish the draught.

Unsuccessful attempts have been made both in England and France, to

* Translated for this Journal, by Prof. A. D. Bache.

apply the hot air blast to bloomery furnaces. The causes of failure are, however, not known.

A similar application to finery furnaces, using charcoal as fuel, has succeeded. Mr. Combes states that at Lausen, (in Wirtemburg) the blast is heated by pipes below the hearth of a finery furnace, and has its temperature raised to 390° Fah. With the cold air blast, they used 40 cubic feet of charcoal to produce 200 lbs. of bar iron, and the weekly yield of the furnace was 6,000 lbs. Now, with the hot air blast, they consume 30 cubic feet of charcoal to the two hundred pounds of iron, or about one part by weight of charcoal, to one of malleable iron; the weekly yield is from 7,200 to 7,800 lbs. On several occasions the consumption of charcoal per 200 lbs. of iron was as high as 36 cubic feet, which the workmen attributed to their using pig iron obtained by the hot air blast, which they considered more difficult to refine than that made with the cold blast.

This last conjecture is opposed to the experience at Konigsbronn, where they do not consider iron reduced by the hot air blast as difficult to refine. The economy of fuel by this method of refining, has been rather more than one-sixth, and the loss in rendering the iron malleable is diminished. This successful result is obtained by using the hot air blast in melting the metal, while it is decarbonized by the aid of the cold blast. This method of operating has been followed with success at the finery furnaces at Creusot and Decazeville.

I was present at some trials made upon a catalonia forge by an association of iron masters of the department of Ariege. These were entirely unsuccessful. In the last of them the consumption of coal was not greater than with the cold blast, but the iron was of very inferior quality.

The hot air blast has been applied to the smith's forge with success. The iron was brought more rapidly to a welding heat, and the loss by oxidation was less than with the cold blast. There was no gain in the consumption of fuel. This method will probably be found useful in the working of steel, but no experiments have yet been made of a decisive character.

On the Use of Raw Coal, or of Wood, in High Furnaces, &c.

In order to produce a high temperature in a furnace, it is obviously necessary that the fuel should be consumed rapidly, and should not give off when heated, any vapours or incombustible gases, to carry off heat. The air thrown in by the draught contains four-fifths of its weight of nitrogen, which becoming heated causes a waste of fuel; if in addition to this, vapourizable matters are present in the fuel, the loss of heat is greatly increased. Charcoal, coke, &c. make such hot fires because their volatile parts have been driven off by previous heating.

In high furnaces wood has been used to advantage, even in the smelting of iron, while it has failed in low ones. In the former the fuel descends slowly, and after having its temperature gradually raised, reaches the part of the furnace in which the blast is most operative. At this place the highest heat is to be found, and here the principal chemical changes take place. Thus in fact the fuel is gradually dried and carbonized before it reaches the place of greatest heat. If it were otherwise, the working of the furnace would be very unsatisfactory.

Experiment has proved the position just taken, however liable to objection it may seem on the score of the high heat which may be supposed, in every furnace, much above the tuyeres. It was found in the Hartz, by trial in a furnace of twenty feet in height, in which lead and copper ores

were smelted, that the wood used as fuel came within six or eight inches of the tuyeres, without having been carbonized. The experiment was made by having small openings made at intervals in the stack, through which the progress of the operation could be examined. In this case the use of wood was abandoned, the furnaces being worked, as before, with charcoal.

A further proof of the same position may be drawn from the fact that raw coal, although substituted for coke, with advantage, in some high furnaces, has not been used in cupolas.

It is then absolutely necessary that the wood, or coal, should be converted into charcoal, or coke, before reaching the reducing part of the furnace. When this does not occur, and this is proved to be sometimes the case, the working of the furnace is unsatisfactory. The nature of the coal will produce different effects in the same kind of furnace. Thus at Alais a gradual deterioration in the working of the furnace resulted from the use of raw coal; at Creusot it was found necessary to mix the raw coal and coke in nearly equal proportions; in Scotland the hot air blast is required to enable them to use raw coal, while in Wales and at Decazeville they use raw coal with the cold air blast. The effect of the hot air blast is doubtless to facilitate the carbonization of the raw fuel. To use wood for the smelting of iron, even in high furnaces, it has been found necessary to dry it before charging with it. This is true both in the Russian furnaces, and at Plons, in the latter of which the hot air blast is used, and the wood is mixed with charcoal. It should be observed further, that resinous woods, easily charred, have been the only ones hitherto tried.

This reasoning shows also why the more or less perfect roasting of an ore, the more or less moist state of the materials of the charge, the more or less complete carbonization of the wood or coal, produce such important effects, even in the largest furnaces. It is plain that the temperature just above the point when the ore is reduced is low, since coal, or wood, is not charred, and that to this we must look for the reason why it is so difficult to use these combustibles in the raw state.

M. Lampadius, of Freyburg, in his essay "on the use of combustibles in their crude state,"* has shown how necessary it is to heat the wood, or turf, to a point near to that in which it begins to carbonize, before using it as fuel. He remarks that the cost of transporting wood or turf being, of course, much greater than the freight upon the charcoal from them, will prevent their use in many cases. Thus if it be supposed that there is a gain of twenty-five per cent in the quantity of charcoal, by using wood not carbonized, as was the case in the Russian furnaces, the balance would at Freyburg, be against the use of the raw material, on account of the cost of transportation. M. Lampadius concludes that when the material is at hand, or the cost of transportation low, uncarbonized wood may be used to advantage, in high furnaces, for smelting iron, if it has been duly dried; a result due to the heat given out in the combustion of the gases driven off from the wood, and to their reducing power.

The cause just assigned seems to me insufficient to explain the very great economy sometimes resulting from the use of the raw material; I consider the effect mainly due to the mode of carbonization, by which a much larger per centage of the carbonized fuel results than by the ordinary methods. The volatile parts of the fuel are driven off by the heated and

*Erdmann's Journal of Chem. and Technology, vol. XII. 1831.

incombustible gases passing through it, and there is no waste, by combustion. Being carbonized slowly, uniformly and without sensible waste, the greatest useful effect must result, and it is easily understood why a given weight of dry wood, or coal, may when thus circumstanced, yield a fourth, or even a half more charcoal, or coke, than it would by the ordinary method, and thus may be competent to reduce a fourth, or half more ore.

It must be admitted however, that this explanation does not account satisfactorily for the very great advantage found in the use of raw coal, in the high furnaces of Scotland, with the hot blast, and at Decazeville with the cold blast. At Decazeville, coal more than replaces an equal weight of coke. Thus one part by weight of coke was used for the fusion of 1.131 of mixed ore and flux, and now one part of coal is used to 1.675 of ore and flux. This coal would yield but .38 ($\frac{3}{8}$ths) of its weight of coke, and melt therefore but .43 of mixed ore and flux. The causes assigned by M. Lampadius, are therefore probably correct, being necessary in addition to that just examined, to explain the various effects.

On the Causes of the Efficacy of the Hot Air Blast.

It is plain that if cold materials are introduced within a furnace, they tend to lower its temperature, while their own is raised. If then the fuel and the blast be heated before they act chemically, to a temperature nearly equal to that of the part of the furnace at which the combination takes place, this heated portion will be increased in extent, its temperature will be higher than it would be under other circumstances, and the amount of heat, therefore, available in melting the ore, &c. will be greater. In smelting furnaces the fuel and ore are always thus heated. This is not the case, however, with the blast. In fact it has hitherto been considered an advantage to have the air as cold as possible, that it might contain more oxygen in a given bulk, and experience showed, in conformity with this view of the matter, that blast furnaces worked better in winter than in summer, and better at night than during the day. The expansion of air by heat causing, under a given pressure, less oxygen to be thrown into the furnace, will produce a diminished consumption of fuel, and yield of metal. In wind furnaces, in reverberating furnaces, and generally in all where an ordinary draught is used, an increased temperature in the air diminishes the draught. It can only be increased by raising the temperature of the air in the furnace, by the use of a more freely burning fuel, by additional attention in firing, &c. The same difficulty occurs in the blast furnace, if the power of the blowing machine cannot be increased.

It so happens that at the very time the air is warmest, springs are lowest, and the condensation of steam most difficult, two facts which will explain why the working of furnaces, both as to quantity and quality, is better in winter than in summer. If the weight of air thrown into the furnace had been made the same in summer as in winter, by increasing the power of the blowing machine, and the area of the blast pipes, it is probable that the working would not have been worse, in the former season than in the latter.

An artificial heating of the blast should produce the same effects as that just alluded to, and it is by no means surprising that the efficacy of the hot blast has been doubted. It remains to be seen whence this efficacy results.

M. Dufrenoy* has, in his explanation of the advantages of the hot air

* Annales des Mines, vol. IV. This Journal, page 419, vol. XV.

blast, shown the difference between the quantities of heat introduced into the furnace with the hot and cold blasts, and in an assumed case has determined this difference to amount to about one-sixteenth of the heat evolved by the combustion of the fuel. Since less air is thrown into the furnace in using the hot blast, there is of course, on that account, less cooling effect to contend against than in the other case.

M. Clement Desormes concludes by calculating from data in an assumed case, that the temperature within the furnace is increased between 270° and 360° Fah. by the heated air blast; an increase which he considers adequate to explain all the observed effects.

These theories are far from settling entirely, the question in an economical point of view. They suppose indeed, that the consumption of fuel in heating the air may be equal to that saved in the reduction of the ore, which is by no means the case.

I propose therefore to classify the observed effects, and to point out their relative degrees of importance, and their connexion with each other and with established physical principles.

The effect of heating air being to diminish its density, and the consequences of this being decidedly bad when the air is but slightly heated, why should a further increase of temperature, even with a diminished pressure and density, produce so great advantages? The explanation is that the temperature of the air has a most important effect on the intensity of combustion, and there is no doubt a point at which this effect begins, and another beyond which it would hardly be sensible. Observation confirms this explanation. Bars of iron are readily raised to a welding heat in a smith's forge, supplied with hot air, in half the time required by the cold blast, and as the same quantity of coal is consumed per day in both cases, the greater effect in the former can only result from an increased intensity of combustion.* In the most successful trials the air was heated to 370° and the diameter of the blast pipe not being changed, the quantity thrown in was actually diminished, and yet there was an increased consumption of fuel. It is then the temperature of the air, and not its density, which determines the intensity of the fire.

In the furnace, then, the fuel is burned to the greatest advantage; but, further, the heat thus produced is rendered most effective. There can be no doubt that, in order to the regular working of the furnace, the different layers of the charge must descend regularly and horizontally. By the hot air process, the fuel is more completely converted into carbonic acid, than in the old process; more fuel is consumed in a given place, the temperature of which is, therefore, higher than in the former case; and this place of intense heat is more extended. As consequences, a greater mass of ore is reduced in a given time by the same weight of fuel, and more refractory ores can be reduced.

The charges descend more slowly, probably, because it requires more time to consume a large quantity of combustible in a given place, than to burn it through a considerable extent of the furnace. The air being com-

* Anthracite coal merely requires its temperature to be sufficiently raised to make it keep up the combustion by the heat which it gives out. Iron wire, to burn in oxygen, requires its temperature to be first raised, and may be burned in chlorine if first fired by the combustion of copper wire. Iron filings, finely divided, burn in the air, and in the experiments of Mr. Tyler, a fire was made in a smith's forge, from iron turnings, by raising the temperature with fine turnings. At last the whole burning mass was iron, and a welding heat was produced upon a bar thrust into it. [Trans.]

pletely deprived of its oxygen in the lower part of the furnace, cannot consume any of the combustible higher up. The charges have all moisture, or gaseous matter, completely driven off by the hot gases passing through them, and arrive, duly heated, at the place where the most intense heating effects are produced. This diminished rate of descent is entirely consistent with an increased yield of metal, since the amount of ore in each charge is increased.

From the intense action referred to above, results a greater fluidity in the slag, a diminution in the quantity of flux, the possible use of more refractory ores, or an increased proportion of others in the charges, and the production of gray pig iron, by proportions in the charge in a furnace, which, before, would yield only white, or mottled, castings.

In conclusion, it may be remarked that some changes may probably be made with advantage in the forms of furnaces using the hot air blast. It is difficult to point them out, and their determination will require repeated trials, and with the precise ores and combustibles intended to be used in a particular case. I would suggest, however, especially where forged iron is to be made, enlarging the furnace at and above the boshes, diminishing, at the same time, the height of the whole furnace. This latter change is understood to have already been made with advantage, in certain furnaces using charcoal as a fuel.

Effect of Drawing, Rolling, Annealing, &c., of the Metals.—In a paper on the ductility and malleability of certain metals, and on the variations of density which they undergo by different operations, M. Baudrimont developes the following interesting facts.

At a temperature rather above a cherry red, iron wire remained three months, surrounded by charcoal, without cementation taking place. A white heat, in five minutes, gave the properties of cast-iron to a square bar of malleable iron, of four-tenths of an inch on a side.

Wires of copper, and of alloys of copper and zinc, are increased in diameter, and diminished in density, by annealing. The operation of rolling condenses the metals more than that of wire drawing. The density of iron and copper is greater, if the metals are heated before being passed through the rollers. The reverse is the case with alloys of copper and zinc. The density of the metals is greatest when drawn into very fine wires.

Wires may be increased in length in two ways, by a diminution in the area of their cross section, or by increasing the distances between their particles. When wires are lengthened in the manner last named, they return to their former length by annealing.

Hydrogen has an action on copper and silver, at high temperatures, which permanently separates their particles. On alloys of copper and zinc, and even of silver and copper, it has no such action.

Wires of different metals, which, after passing through the same hole in the wire drawing plate, have different diameters, acquire equal diameters by annealing.

The diameter of a wire increases, very slowly, by time, after passing through the wire drawing plate. Wires which have been bent, and then straightened, re-acquire a curvature.

Wires exposed to a high heat, lose a part of their tenacity. They require to be annealed in wire drawing, not to render them more tenacious, but to allow the particles to resume the positions from which they may again be

displaced. The loss of tenacity is common to copper, iron, platinum, and the alloys of copper and zinc.

Brass wire approaches to iron in strength, while copper is inferior to it. Brass may be used instead of iron, where the latter would oxidate too rapidly.

The iron wires are given at strengths from 79,000 lbs. to the square inch to 127,600 lbs. The brass wires, from 78 to 87,000 lbs. to the square inch. Copper, from 38 to 44,000 lbs. The diameters of the least and greatest wires were, iron, .014 inch, and .205 inch; brass, .070 and .267 inch; copper, .019 and .285 inch.

The finer wires bear greater weights, in proportion to their areas, than the coarser ones, because the particles of the former are compacted through the whole cross section, while those of the latter, for a certain depth only, are thus forced together.—*Ann. de Chim. et de Phys.*

A short Remark or two on what is commonly called Dry Rot, by Charles Waterton, Esq.—Dry rot is a misnomer. This disease in timber ought to be designated a decomposition of wood by its own internal juices, which have become vitiated for want of a free circulation of air.

If you rear a piece of timber, newly cut down, in an upright position in the open air, it will last for ages. Put another piece of the same tree into a ship, or into a house, where there is no access to the fresh air, and ere long it will be decomposed.

But should you have painted the piece of wood which you placed in an upright position, it will not last long; because, the paint having stopped up its pores, the incarcerated juices have become vitiated, and have caused the wood to rot. Nine times in ten, wood is painted too soon. The upright unpainted posts, in the houses of our ancestors, though exposed to the heats of summer, and the blasts of winter, have lasted for centuries; because the pores of the wood were not closed by any external application of tar or paint; and thus the juices had an opportunity of drying up gradually.

In 1827, on making some alterations in a passage, I put down and painted a new plinth, made of the best, and apparently, well-seasoned foreign deal. The stone wall was faced with wood and laths; and the plaster was so well worked to the plinth, that it might be said to have been air-tight. In about four months, a yellow fungus was perceived to ooze out between the bottom of the plinth and the flags; and on taking up the plinth, both it and the laths, and the ends of the upright pieces of wood to which the laths had been nailed, were found in as complete a state of decomposition as though they had been buried in a hot-bed. Part of these materials exhibited the appearance of what is usually called dry rot; and part was still moist, with fungus on it, sending forth a very disagreeable odour. A new plinth was immediately put down; and holes, $1\frac{1}{4}$ inches in diameter, at every yard, were bored through it. This admitted a free circulation of air; and to this day the wood is as sound and good as the day on which it was first put down. The same year, I reared up, in the end of a neglected and notoriously damp barn, a lot of newly felled larch poles; and I placed another lot of larch poles against the wall on the outside of the same barn. These are now good and well seasoned: those within became tainted the first year, with what is called dry rot, and were used for firewood.

If, then, you admit a free circulation of air to the timber which is used in a house (no difficult matter) and abstain from painting that timber till it

be perfectly seasoned, you will never suffer from what is called dry rot. And if the naval architect, by means of air-holes in the gunwale of a vessel (which might be closed in bad weather), could admit a free circulation of air to the timbers; and if he could, also, abstain from painting, or doing with turpentine, &c., the outer parts of the vessel, till the wood had become sufficiently seasoned, he would not have to complain of dry rot. I am of opinion, that if a vessel were to make three or four voyages before it is painted, or done with turpentine, &c., its outer wood would suffer much less from the influence of the weather than it usually suffers from its own internal juices, which cannot get vent, on account of artificial applications to the pores. But still the timber would be subject to the depredation of the insect. To prevent this effectually, Mr. Kyan's process must absolutely be adopted; and it must also be adopted to secure wood from what is called dry rot, in places where a free circulation of air cannot be introduced. I consider Mr. Kyan's process perfectly unexceptionable. The long arrows which the Indians use in Guiana are very subject to be eaten by the worm. In 1812, I applied the solution of corrosive sublimate to a large quantity of these arrows. At this hour they are perfectly sound, and show no appearance that the worm has ever tried to feed upon them.

I have penned down these transient remarks by way of preface to others, which I may possibly write, at some future time, on decay in living trees.

Loudon's Architect. Mag.

New Spirit Lamp.—A new and convenient spirit lamp, with an eolipyle having a vertical jet, is described by M. Pelletan, as the invention of M. Breuzin, of Paris. The entire apparatus is placed on a neat tripod stand, arranged for holding the vessel to be heated. The wick of the lamp is hollow, and is raised or depressed by a screw and rack. Above the lamp is an eolipyle of a cylindrical shape, through the middle of which the flame of the lamp passes. The vessel to be heated being placed above the eolipyle, retains the full effect of the flame of the lamp. The jet pipe from the eolipyle passes downwards, and by a bend is introduced into the axis of the cylindrical wick of the lamp. The alcohol flame is thus entirely vertical, and the apparatus is much more convenient than the common eolipyle where the jet is horizontal. By using vessels properly arranged to economise heat, a pint of water may be boiled in five minutes, and at a cost of less than half a cent (at Paris.) In a common coffee biggin, the same quantity of water may be boiled for about a cent. (*Jour. Connaiss. Us. et Prat.*)

Application of Tannate of Gelatin to taking Casts from Medals, &c.—This substance is obtained by adding a decoction of gall nuts, sumac, oak bark, or other substance containing tannin, to a solution of glue or isinglass, in water. It is fibrous and nearly insoluble. When exposed to the air in thin layers, it hardens. When moist, it is elastic.

The substance which was found to give the best mixture for casts, was finely pulverized slate. Silica, emery, &c. give pastes which harden, and may be used for razor straps.

In making casts of the mixture of tannate of gelatin and pulverized slate, it must be left for a certain time in the mould, in order to preserve the impression. If, however, it is allowed to remain there too long, it adheres strongly. The only difficulty in the application is to ascertain the precise time required for due hardening.

This substance may replace bronze in ornaments, papier maché, card work, &c. *Ibid.*

Analysis of two varieties of Bronze.—These specimens were analyzed by M. Berthier. The first was intended for the manufacture of cannon, but proved of bad quality; its composition was ascertained to avoid the same proportions in other mixtures. It consisted in 100 parts, of copper 83.8, tin 15.7, lead 0.5.

The bronze used at Paris for the striking parts of clocks, was found to be composed in 100 parts, of 71 to 72 of copper, 26.56 to 27 of tin, 1.44 to 2 of iron. *Ann. des Mines, vol.* VII.

Sheathing of Ships with Bronze.—The sheathing of this metal has been found by experiment, to lose but half the weight, in a given time, which copper would have lost. The composition used for making sheet bronze is 91 of copper and 9 of tin. *Ibid.*

Durability of Acacia Wood.—It was found that in the mining galleries at Carmaux, (France) the oak timber used to support the sides and top of the galleries, decayed very rapidly, being affected by the dry rot. A comparative experiment was made with acacia wood, from which it resulted that the latter wood is much more durable than the former, when exposed in such situations. Oak timber decayed in three months, while the acacia was unacted upon, except at the sap-wood surface, in four years.

The lateral strength of this wood is about equal to that of Norway pine. *Ann. des Mines, vol.* VII.

Progress of Physical Science.

Experimental Researches in Electricity. Eighth Series. By Michael Faraday, &c. &c. *Phil. Trans., Lond.*, 1835.

(Abstract concluded from page 285.)

13. The actions of dilute sulphuric acid on the zinc plates of a galvanic circle, may be distinguished into two parts. one which acts directly on the zinc, evolving hydrogen on its surface, the other which "producing an arrangement of the chemical forces throughout the electrolyte present (in this case water) tends to take oxygen from it, but cannot do so, unless the electric current consequent thereon can have free passage, and the hydrogen be delivered elsewhere than against the zinc. The electric current depends altogether upon the second of these."

(*a.*) In the ordinary use of zinc in the galvanic battery, there is a waste of power amounting to all the chemical action which takes place when the (electrodes) poles are not united. This is placed in a strong point of view by recollecting that the proper oxidation of three and a half ounces of zinc should decompose nearly one ounce of water, and evolve about 2400 cubic inches of hydrogen gas.

(*b.*) When impure (common) zinc is used, this loss of power is greater than when pure zinc is employed. The metallic impurities forming small galvanic circles on the zinc, tending to convey the electricity back to the zinc.

(*c.*) Amalgamated zinc has no such defects. It decomposes the water of the acid solution only when the circuit is completed. It ceases to act as soon as the poles are separated, and hence economy of both metal and acid. The mercury probably acts by bringing the whole surface of the zinc into a uniform condition, so that one part has no more tendency to evolve electricity than another, and hence no discharges take place from one point of the metal to another. A battery formed of such plates has the powerful

condition incident to rest renewed, by merely separating the poles. It soon arrives at a permanent condition, any oxide formed at the surface of the zinc plates, being removed as soon as produced.

14. The voltaic battery may, possibly, in its improved forms, become applicable to manufacturing purposes, for, by it, an equivalent of a rare substance may be obtained, at the expense of several equivalents of common ones, such as zinc, and sulphuric acid.

15. If a zinc and platinum plate, plunged into dilute acid, be connected, by wires, with two platinum plates, which are also immersed in dilute acid, the electricity evolved by the action of the zinc in decomposing water, cannot pass, unless the water in the second cup be also decomposed. A similar arrangement will be formed, if a cell, to contain dilute acid, have, on one side of it, a zinc plate; on the opposite, a platinum plate, connected, by a platinum wire, with the zinc; and, midway between these two plates, a second platinum plate; the water between the zinc and middle platinum plate cannot be decomposed, unless the electricity evolved can also decompose the water between the two platinum plates. Mr. Faraday calls this second platinum plate, against the sides of which, the hydrogen and oxygen are evolved, the interposed plate. From the action of interposed plates, he draws new proofs of the identity of electrical forces with chemical affinity. The facts, and their explanations, are as follows.

(*a.*) When dilute sulphuric acid was used in the cell, with one pair of plates, before alluded to, one interposed plate stopped the current. One interposed plate effectually stopped the current of two galvanic pairs, but allowed that from three to pass.

The distance between the interposed plates, and their size, did not vary the result. When nitric acid was added to the liquid between the interposed plates, the current from one pair could pass, and when also added in the cell, between the galvanic plates, the current passed freely. Muriatic acid produced a less effect.

The current does not pass in the first mentioned case, because the water in the interposed cell must first be decomposed, and this it cannot be, unless the zinc have twice the affinity for oxygen that hydrogen has, since these elements are to be separated from each other, both in the cell between the galvanic plates, and in the interposed cell. This explains why the current from two pairs of plates may pass feebly, while that from three has free passage. The affinity of hydrogen and oxygen for each other being the resisting force, and not the want of conducting power in the interposed fluid, the thickness of the interposed stratum is, within limits, not an element in the effect. When nitric acid is added to the liquid in the interposed cell, its oxygen combines with the hydrogen of the water, when decomposed, and hence an affinity is introduced to aid decomposition.

(*b.*) When two interposed platinum plates were used, they allowed a feeble current from five plates to pass, and none from four. When four interposed plates were used, a very feeble current passed; by the removal of one of them, a somewhat stronger current passed; and with only one plate, the current was little obstructed. The effect of successive interpositions appears, as it ought to be, very different.

(*c.*) In all these experiments, a very feeble current, at first was observed to pass, water conducting such a current as the metals do, but in an imperfect degree.

(*d.*) When zinc was used to form any number of interposed plates, no apparent retardation of the current resulted. The zinc, of itself, being able

to decompose water. Amalgamated zinc plates, two in number, retarded the current, though a single one appeared not materially to affect it.

16. The strength of action of a galvanic battery declines, not only from the products of its own action, but, in certain cases, from the curious condition of metals, by which there is a tendency to produce a reverse current.

(*a.*) The effect of the combination of the acid used in the cells of a battery, with the oxide of zinc, explains the rapid declension of galvanic action, and the reason why stopping the current, or removing the plates from the acid, causes a recovery of energy.

(*b.*) The second cause of declension is illustrated by using a cell similar to that described for investigating the effect of one interposed plate. A platinum wire, joining the exterior and interior platinum plates, was found by the galvanometer to have a powerful momentary current passing through it, at the instant of joining the plates, and in a reverse direction to that produced by the galvanic circle.

(*c.*) This peculiarity is traced as the cause why an interposed plate of copper at first allowed the current from one pair of plates to pass, and afterwards appeared to stop it. By turning the copper plate round, so as to change the directions of the exposed surfaces, the effects were reversed.

(*d.*) This same condition explains why a battery of platinum and copper plates, with dilute sulphuric acid, is competent to act only for a short time.

On Springs, Artesian Wells and Spouting Fountains, by M. Arago. By artesian wells are meant those of which the waters rise to or above the surface, on boring to a greater or less depth. They were known to the ancients, exist in the deserts of Sahara, as well as in the fertile plains of Southern France. They are called artesian from the Latin name of the county of Artois, in France.

M. Arago examines the following questions, and derives the conclusions which are stated.

1. Whence is the water of these wells derived? Not by filtration of sea water. Not by the evaporation and subsequent condensation of subterranean waters, but by the filtration of rain water until it reaches strata which prevent further progress. A recent guaging of the Seine has shown that but one-third of the water which it receives from rain, &c. reaches the sea, leaving two-thirds to be accounted for by evaporation, by that consumed in the support of vegetable and animal life, and by filtration.

2. How does this filtered water exist and circulate in the various formations which compose the earth's crust? In primary rocks springs are found to be small, and the issues are near the sources of the water. The stratified rocks of the secondary formations afford excellent floors for the passage of subterranean waters. They sometimes form basins, in some of which water collects. In the secondary strata springs are more rare than in the tertiary, but give more water when struck.

3. What power raises the water of artesian wells to or above the surface? Hydrostatic pressure. The water-bearing strata form reversed syphon-shaped interstices, and the pressure of the water in one branch raises the water in the other. In Artois this pressure must be transmitted sometimes more than one hundred miles.

M. Arago developes the following among other interesting facts.

The temperature of the water in these wells is uniformly higher than that of the surface at which they escape.

One of these wells in France, made in excavating for coal, is 1000 feet deep. Chiswick spring is supplied by a well bored to the depth of 582

We append to the foregoing report of the Committee on Explosions, a document which appears in the authorized copy of the report as a preface, and which contains an account of the transactions of the Committee.

COM. PUB.

PREFACE.

The Committee, whose report of experiments, made by the request of the Secretary of the Treasury of the United States, is presented in the following pages, was appointed on the 10th of June, 1830, for the purposes expressed in the annexed resolution of the Board of Managers of the Franklin Institute, of the State of Pennsylvania, for the promotion of the Mechanic Arts.

"*Resolved*, That a committee of seventeen members be appointed, to examine into the causes of the explosions of the boilers used on board of steamboats, and to devise the most effectual means of preventing the accidents, or of diminishing the extent of their injurious effects."*

The Committee consisted of the following named members of the Institute.

Alex. D. Bache, *Chairman.*

Robert Hare, M. D.	J. K. Mitchell, M. D.
S. V. Merrick,	Benjamin Reeves,
W. H. Keating,	George Fox,
Isaiah Lukens,	Thomas P. Jones, M. D.
James J. Rush,	W. R. Johnson,
James Ronaldson,	M. W. Baldwin,
Frederick Graff,	James P. Espy,
R. M. Patterson, M. D.	George Merrick.

Immediately after their appointment, the Committee addressed a circular letter to persons, whom they supposed would be able to give information, in regard to the explosions of steam-boilers which had occurred in our country, or abroad, and of which no accounts had been previously published. They took, also, other means to inform themselves on the subject referred to them.

The information derived from replies to the circular has already been made public.†

While the Committee were engaged in the inquiries necessary to enable them to report to the Managers of the Franklin Institute, a letter was received by that body from the Secretary of the Treasury of the United States, informing them that funds had been placed, by the House of Representatives, at the disposal of the department, for inquiries in regard to the explosions of steam-boilers, and inviting experiments on the subject, by the Institute, at the expense of the Treasury Department.

A series of questions, connected with the probable causes of explosion, or with theories which have been offered in relation to them, and with the safety of the steam engine, was submitted to the Secretary of the Treasury, with a plan of experiment based upon the queries, and an estimate of the cost of the experiments. This plan was approved, and authority given to add to the original subjects proposed for investigation, any others which might suggest themselves in the course of the experiments; the amount to be expended being, however, limited.

* This resolution was moved by W. H. Keating, Esq., who subsequently declined the chair of the Committee, and Prof. A. D. Bache was chosen chairman.

† Journal Franklin Institute, vols. viii., ix., and x.

In order to carry on the experiments, the following sub-committees were appointed.

1. On the experiments,* excepting those relating to the strength of iron and copper.

Messrs. A. D. Bache, M. W. Baldwin,
Benjamin Reeves, S. V. Merrick,
W. H. Keating, Isaiah Lukens.

2. On the strength of iron and copper used for steam-boilers.†

Messrs. W. R. Johnson,
A. D. Bache,
Benjamin Reeves.

The first of these sub-committees presented the report of their experimental investigations, which, having been examined by the Committee, was finally adopted on the 23d of December, 1835, and ordered to be submitted, through the Managers of the Institute, to the Secretary of the Treasury.

The labours of the second sub-committee, as well as a report on the subjects in relation to which the Committee was appointed, yet remain to be presented.

It was deemed proper to delay such a report, until all the light which the experiments could afford, had been shed upon the important and intricate subject referred to the Committee.

On behalf and by direction of the Committee, &c.

ALEX. DALLAS BACHE, *Chairman.*

FOR THE JOURNAL OF THE FRANKLIN INSTITUTE.

Account of the Explosion of the Boiler of the Steamboat Wm. Gibbons. By THOMAS EWBANK, of New York.‡

This explosion occurred on Thursday morning, January 21st, as the boat was entering this harbour, on her return from Charleston, (S. C.) By this melancholy disaster, six lives have been lost.

The Wm. Gibbons has but one boiler, made of wrought iron, and similar in its construction to those of the "Ohio," and "New England," but having a greater number of horizontal flues. These terminate, as in the boilers of those boats, in a large vertical flue, which passes through the roof of the boiler. It was this flue which was collapsed. The following memoranda were made by me on different visits to the boat.

January 24. I visited the Wm. Gibbons this day. The chimney proper, or smoke pipe, (represented by the dotted lines, *a*, *a*, in the annexed sketch, Plate XVII., Fig. 1,) had been removed. Upon looking down, the collapse was quite obvious. The flue was pressed together, so as to be closed almost entirely at the part where the rent had taken place. A section of

* This sub-committee had the subjects referred to them on the 1st of November, 1830.

† Appointed January 4th, 1831.

‡ This interesting account was addressed to the Committee on Explosions, in consequence of a request made to Mr. Ewbank by a member of that Committee. We feel persuaded that if intelligent men at the different places near which explosions occur, would take pains to ascertain the nature of the effects, and make public the results of their examinations, the cause of humanity would be essentially served. It will be seen that Mr. Allaire, the maker of the boiler of the Wm. Gibbons, has set a most praiseworthy example, by affording every facility for examining the effects of the explosion.

COM. PUB.

that part is represented at F, Fig. 2, exhibiting a three cusped figure, instead of that of a circle, its original form. As the flue was still enclosed in the case B, the precise situation of the rent with respect to the surface of the water in the boiler, could not then be accurately ascertained, without entering the boiler. The collapsed flue is made of quarter inch iron, and is three feet in diameter. A space of seven inches is left between it and B. The steam pipe, S, is connected to the latter at its upper end, which is eight feet above the roof of the boiler.

January 26. This day B was removed, leaving the ruptured and vertical flue, C in the sketch, fully exposed to view. The rent, R, was four inches above the roof of the boiler. It was in one of the horizontal seams, and confined almost wholly to it; it extended nearly three feet, or about one-third of the circumference. The line of separation was through the centre of the rivet holes, nearly the whole extent, a strip of metal thus separated being left in its place, in the lower portion of the flue. The iron is cracked in some places, where the flexure has been greatest, as at O.

Through the politeness of James P. Allaire, Esq., the builder of the engine and boiler, and also one of the owners of the boat, I have obtained a portion of the ruptured flue, which is sent with this communication. It is from one end of the rent. The thickness of the metal at the part ruptured is not sensibly diminished, as will be perceived by the specimen sent. The question of the deterioration of the metal by heat, may perhaps be determined by it also.

The original cause of this explosion is conceived to be identical with that of the Ohio,* and is to be found in the "construction of the boiler," the arrangement of the flues in it being such that the principal one, (that which collapsed,) could not be protected by the water. Its exposure to high degrees of temperature, under these circumstances, must necessarily diminish its strength very materially. The increase of its temperature is also accompanied with an increased elasticity of the steam; hence its power of resisting the pressure around it diminishes as that power is augmented.

In addition to the remarks made on these flues in the case of the Ohio, it may be further observed, that, from their greater dimensions compared with the horizontal ones, their strength necessarily bears no comparison with that of the latter, even if covered, like them, with water. How much more liable to destruction, then, are they, wholly unprotected by it? The horizontal flues of the Wm. Gibbons do not exceed twelve inches in diameter; the ruptured flue, as before observed, is thirty-six inches.

If steam chimnies are deemed indispensable, would it not be safer to convey each horizontal flue separately through the roof of the boiler, than to combine them all in the large one in question?

The surest remedy, however, is to make all interior flues terminate outside of the boiler, *below* the water line. Neither this explosion, nor that of the Ohio, could have occurred, if such had been the arrangement in their respective boilers.

The immediate cause of the explosion is attributed, and no doubt justly, to the imprudence of the second engineer, and two of the firemen,† in wantonly urging the fire with quantities of wood, (anthracite coal being the principal fuel used,) and thus unnecessarily, at that time, increasing the force of the steam, and the heat of the vertical flue, against the positive and

* See this Journal, vol. x., p. 226, Ewbank on the Explosion of the Steamboat Ohio. The effects on the boiler, in that case and this, are strikingly similar. Com. Pub.

† They were all killed.

repeated directions of the chief engineer, who was very unwell at the time. It appears that one or more of them ridiculed the apprehensions of that officer, while in this act of disobeying his orders. His reasons for giving such directions are not left to conjecture, when we learn that, off Cape Hatteras, he had discovered that the vertical flue was pressed inwards, in one place, although but slightly. This is the fact referred to by one of the passengers, (Mr. Newmark,) in the statement which follows. The *repairs* done to the boiler, near Cape Hatteras, were in consequence of a leak near one of the fire doors.

The engine and boiler were considered in good repair; there was no design to repair either previous to the next trip, as has been stated in some of the papers. The only alterations contemplated were in the paddles, which they are now undergoing.

The following statement of a number of the passengers who were on board of the William Gibbons, was published just subsequent to the explosion.

To the Public.

The undersigned, passengers on board the steam packet Wm. Gibbons, on the occasion of her late disastrous trip from Charleston to this port, convinced that no adequate account has yet been given to the public of the circumstances connected with the explosion, by which six unfortunate individuals were hurried away in all the vigour of life, feel it to be their duty to submit to the community a concise statement of certain facts within their personal knowledge. Events so calamitous, however great the individual anguish of which they are the occasion, may, nevertheless, be the source of some public good; but this good can spring only from a development of all their attendant circumstances, to such an extent that they may constitute a warning and a lesson for the future.

The Gibbons left Charleston on the morning of Sunday, the 17th of January, at 10 o'clock. On Monday, about sunset, she passed Cape Hatteras. Not long afterward, the engine was stopped, the fires extinguished, and the water discharged from the boiler. The whole night was consumed in repairs, with the precise nature of which we were, at the time, unacquainted. The inquiries of the passengers failed to elicit any satisfactory information; there seemed, indeed, to exist a studied determination, on the part of those in authority on board, to avoid making any disclosures.

After this time we carried very low steam, the gauge rod not standing generally higher than seven, eight, or nine inches. Before reaching Cape Hatteras, it had stood usually at fifteen, sixteen, or eighteen. Being in plain sight, it was frequently noticed, for many of the passengers were suspicious of our danger, and mentioned their apprehensions repeatedly.

On Thursday morning, it was remarked that we were again carrying heavy steam, a circumstance which had not been before observed since the occurrence at Cape Hatteras. A gentleman who was standing near the steam chimney, for the purpose of warming himself, called the attention of another to the fact that the rod stood at fifteen inches. This was mentioned to several, who observed that our speed indicated high pressure. These gentlemen believe that not more than ten or fifteen minutes had elapsed after this observation, before the explosion took place. In order, however, to be perfectly safe, they are willing to testify that the time was not greater than half an hour; our speed, meanwhile, by no means indicating a diminished power. Let this be compared with the statement which has been given to the public, that, at the moment of the accident, the rod stood at

feet. A well in the department of Pas de Calais throws its water to the height of seven feet above the ground, and is 461 feet deep.

Unpleasant effects upon the system at great heights.—The vertigo and other disagreeable sensations experienced at great elevations are due, according to M. Boussingault, the intrepid traveller who has recently ascended Chimborazo, (1831) to the exertion of the lungs in speaking. At the height of three miles they found the air nearly saturated with moisture, the thermometer being at $\frac{3}{4}$ of a degree of Fahrenheit's scale, above the freezing point of water. The cracking of the skin is not due then to the dryness of the air. It is to be explained by the excessive quantity of light reflected from the snow and ice, and to be guarded against by a veil of gauze or crape, of suitable colour.

M. Boussingault and his companions attained the height of three miles and three quarters above the level of the sea.—*Ann. de Chim. et de Phys.*

Comets shine by reflected light.—M. Arago considers himself entitled to infer, positively, from observations made during the recent return of Halley's comet, that this body, like the planets, derives its light from the sun.—*Jameson's Journal.*

Aurora Borealis, of October 18th, 1835.—It will be remembered that a very splendid display of the aurora was seen in the United States, on this evening, and a less brilliant and extensive one on the 19th. The aurora was seen throughout Great Britain on the same evening. At Paris, where the weather was cloudy, the magnetic needle was considerably disturbed on the 17th, 18th and 19th of November. At Nismes, in France, there was a brilliant aurora seen on the 18th.

Mechanics' Register.

Water-Proof Fabric.—The following composition for rendering cloth, paper, &c. water-proof, is the subject of a recent patent in England. Dissolve half an ounce of isinglass in a pound of soft water. Dissolve one ounce of alum in two pounds of water. Also one quarter of an ounce of soap in one pound of water. After straining each solution, if necessary, to separate impurities, mix them, and simmer over a fire for a short time. The liquid is to be used hot.

This liquid is considered applicable to cloths; for lighter fabrics the proportions and ingredients are varied as follows. One quarter of an ounce of isinglass to a pound of water. Three ounces of alum in three pounds of water. Half an ounce of soap in an ounce and a half of oil of turpentine, and mix it with a pound and a half of water. One ounce of fine glue in a pound of rain water. One ounce of gum arabic into half a pound of water. The alum, glue and gum, after being separately dissolved, are to be mixed and some time afterwards the soap is to be added. The ingredients to be mixed hot.—*Lond. Rep. Pat. Invent.*

Magnetic Locomotive Engine.—A very successful trial of a locomotive impelled by magnetic force, is *said* to have been made by M. Lemaire, of Brussels.

Prize Chronometers.—The first prize of £200, for chronometers, deposited, and under trial at the Greenwich Observatory, has not been awarded during the past year.—*Arcana of Sc.* 1835.

Birmingham Organ.—This very large and powerful instrument has been

put up in the town hall of Birmingham. The space occupied by it is 35 feet in width, 15 feet in depth, and 45 feet in height. There are four rows of keys, and sixty stops. The largest pipe has a capacity of 217 cubic feet. The town hall will seat between three and four thousand persons. —*Arcana of Sc.* 1835.

Preservation of Plants in Brine.—Strong brine is stated by a correspondent of the Linnæan Society, to preserve plants, without affecting their colours.

Vapour Cave at Pyrmont.—A cavern has been excavated near the celebrated springs of Pyrmont, in imitation of the Grotto del Cane, near Naples. The air at the bottom of the cavern contains in one hundred parts, 48 of carbonic acid, and 52 of atmospheric air, by measure.—*Arcana Sc.* 1835.

Cultivation of Beet in France.—Two acres and a half of good land produces 47 cwt. 36 lbs. of beet root. From 100 lbs. of which seven or eight of saccharine matter is obtained, a part of which is molasses, the rest sugar. The pulp remaining, after extracting the sugar, affords a nutritious food for cattle.—*Arcana of Sc.* 1835.

Insects destroyed by Chamomile.—This herb, either in decoction or powdered, will destroy insects upon plants; even the growing herb has this effect.

New Journal of Popular Science.—The Society for the illustration and encouragement of Practical Science, well known for their exhibition room, the Adelaide Gallery, London, have undertaken a "Magazine of Popular Science, or Journal of the Useful Arts," of which the first number appeared on the first of February last.

List of American Patents which issued in February, 1836.

		February
41.	*Peeling apples.*—John W. Hatcher, Bedford county, Virginia,	3
42.	*Cooking stove.*—R. G. Cochran, Francistown, N. H.	3
43.	*Ropes and cordage.*—William Fanning, New York,	3
44.	*Cooking stove.*—Daniel Williams, Scaghticoke, N. Y.	3
45.	*Cultivator.*—James M. Garnett, Loretto, Virginia,	3
46.	*Shelling corn.*—Isaac A. Hedges, Elmira, N. Y.	3
47.	*Oven.*—Samuel Pollard, Orono, Maine,	3
48.	*Saw mill.*—George W. Black, Montgomery county, Tennessee,	3
49.	*Straw cutter.*—Isaac O. Wright, Elbridge, N. Y.	3
50.	*Mowing, thrashing, &c. machine.*—E. Briggs and G. G. Carpenter, Fort Lovington, N. Y.	5
51.	*Saddle tree.*—Andrew R. McBride, Williamson county, Tennessee,	5
52.	*Horse rake.*—Joseph W. Webb, Mount Morris, N. Y.	5
53.	*Smut and hulling machine.*—Samuel Richardson, Elmira, N. Y.	5
54.	*Tobacco press.*—A. M. McLean, Russelville, Kentucky,	5
55.	*Horse power.*—Dudley Marvin, New York,	5
56.	*Churn.*—Hezekiah Roberts, Seneca Falls, N. Y.	5
57.	*Bark, &c. for tanning.*—Daniel Williams, Boston, Mass.	5
58.	*Cotton Gin.*—W. and J. McCreight, Winsborough, S. C.	5
59.	*Grist mill.*—W. and J. McCreight, Winsborough, S. C.	5
60.	*Locomotive engines.*—H. R. Campbell, N. L. Philadelphia,	5
61.	*Bee hive.*—J. M. Hubbard, Canterbury, N. H.	5
62.	*Patterns, &c. for casting.*—Lewis H. Maus, Danville, Pennsylvania,	5
63.	*Thrashing machine.*—Lewis H. Maus, Danville, Pennsylvania,	5
64.	*Saw mill saw.*—B. K. Barber, Johnsburgh, N. Y.	5
65.	*Blood, equalizing the*—S. R. Terrell, Burton, Miss.	5
66.	*Mortice locks.*—P. and E. W. Blake, New Haven, Connecticut,	5
67.	*Flour cooler.*—Josiah Pope, Windham, Maine,	5
68.	*Fermenting and distilling.*—Joseph Stowell, Manchester, N. H.	5

69. *Cramping boot legs.*—William Gerrish, Poland, Maine, 10
70. *Gun locks.*—Samuel Morrison, Milton, Pennsylvania, 10
71. *Twain water wheel.*—William L. Elgar, Winchester, N. H. 10
72. *Planing machine.*—Melzer Tuells, Milo, N. Y. 10
73. *Shelling corn.*—Henry G. Neale, Poultney, Vermont, 10
74. *Straw cutter.*—C. D. Skinner and D. Read, Haddam, Connecticut, 10
75. *Churn.*—Lyman Whittier, Vienna, Maine, 10
76. *Straw cutter.*—Joseph Everod, Geneva, N. Y. 10
77. *Thrashing machine.*—Thomas Beede, Sandwich, N. H. 10
78. *Grate and cooking stove.*—John J. Giraud, Baltimore, Maryland, 10
79. *Molasses faucet.*—Charles W. Pickham, New Haven, Connecticut, 10
80. *Spindle and flyer.*—Willard T. Eddy, Ithaca, N. Y. 10
81. *Slide valve.*—A. McCausland, jr. Philadelphia, 10
82. *Crane.*—Elias Marsh, Oswego, N. Y. 12
83. *Piano forte.*—John Pettrick, New York, 12
84. *Boats.*—Edward Fitzpatrick, Mount Morris, N. Y. 12
85. *Churn.*—John E. Thomas, Winchester, Ohio, 12
86. *Horse power.*—Joseph Mustin, Franklin county, Vermont, 12
87. *Feathers, cleaning, &c.*—Daniel K. Hall, New York, 12
88. *Door fastenings for cars.*—John K. Smith, Port Clinton, Pennsylvania, 12
89. *Feathers, dressing.*—Samuel Keplinger, Baltimore, Maryland, 12
90. *Washing machine.*—Luther Davis, Norwich, Connecticnt, 12
91. *Drying cotton, &c.*—John Philbrick, Cold Springs, Miss. 12
92. *Blow-pipe for furnaces.*—John Barker, Baltimore, Maryland, 12
93. *Sliding grate.*—John C. Howard, Hampton, Connecticut, 13
94. *Shelling corn.*—Ira Smith, Downingtown, Pennsylvania, 13
95. *Screws, making.*—William Keane, Monroe, N. Y. 13
96. *Fanning machine.*—D. Flanders and C. Rathburn, Fort Covington, N. Y. 13
97. *Sausage meat cutting.*—Ambrose Henkel, New Market, Virginia, 13
98. *Hydraulic dock.*—Zebedee King, New York, 13
99. *Belt saw.*—William Carey, Poughkeepsie, N. Y. 17
100. *Cannon for chain shot.*—Edward Gordon, Hingham, Mass. 17
101. *Hulling clover seed.*—J. B. and W. F. Pougue, Lexington, Virginia, 17
102. *Bolt for mail bags, &c.*—Ira Atkins, Hanover, N. H. 17
103. *Mortice latch.*—William Coover, Erie, Pennsylvania, 17
104. *Spark catcher.*—Abraham McDonough, Philadelphia, 17
105. *Puppet valves, raising, &c.*—W. Duff and T. Murphy, Baltimore, Maryland, 17
106. *Tire for wheels.*—James H. Rogers, Mount Morris, N. Y. 17
107. *Rice starch.*—W. and T. Liversidge, Dorchester, Mass. 17
108. *Rotary steam engine.*—Aaron Clark, Bangor, Maine, 17
109. *Truss for hernia.*—William Adair, Pleasant Hill, Kentucky, 17
110. *Paper making machine.*—Charles Forbes, E. Hartford, Connecticut, 20
111. *Glasses for spectacles.*—Isaac Schnaitman, N. L. Philadelphia, 20
112. *Sawing staves, &c.*—A. Band and S. Heywood, Lunenburg, Mass. 20
113. *Salt, supplying.*—Peter Cooper, New York.* 20
114. *Pumps, suction,* &c.—Thomas C. Barton, Washington, N. J. 20
115. *Flyers for spinning.*—Samuel Ladd, Waltham, Mass. 20
116. *Saw mill, cross cutting.*—Rufus Riker, Dexter, Maine, 20
117. *Curing sores.*—Reuben Rood, Centre Lisle, Brown county, N. Y. 20
118. *Time-pieces.*—William Pardee, Poughkeepsie, N. Y. 20
119. *Still.*—John Wright, New York, 20
120. *Thrashing machine.*—James Cooper, Greene county, Ohio, 20
121. *Winnowing machine.*—David Wilson, Johnston, Vermont, 20
122. *Injecting syringe.*—Joseph Ralph, New York, 25
123. *Truss for hernia.*—Francis H. Newman, Huntsville, Alabama, 25
124. *Lathe for gun stocks,* &c.—Abner Town, Woodbury, Vermont, 25
125. *Sawing,* &c. *by lever power.*—Jeremiah Walker, Phillips, Maine, 25
126. *Cooking stove.*—B. and A. Titus, Marshal, N. Y. 25
127. *Pump, vibrating.*—Sampson Davis, Derby, Vermont, 25
128. *Spark catcher.*—Francis Milo, New York, 25
129. *Smut machine.*—Abraham Mudge, Canajoharie, N. Y. 25
130. *Saw mill.*—David Washington, Peru, Mass. 25

*Suspended, but registered by mistake.

131. *Bee hives.*—Ebenezer Beard, New Haven, Maine, 25
132. *Pressing water from clothes.*—Caleb Angerine, New York, 25
133. *Cotton gins.*—Henry Clark, New London, Connecticut, 25
134. *Floom gate.*—Harvey Frink, Chatauque county, N. Y. 25
135. *True meridian, finding,* &c.—William A. Burt, Mount Vernon, Michigan, 25
136. *Saw mill dogs.*—Martin Rich, Ithaca, N. Y. 25
137. *Saw mill dogs.*—Phineas Bennett, Ithaca, N. Y. 25
138. *Fire arms.*—Samuel Colt, Hartford, Connecticut, 25
139. *Boot tree.*—Matthew Matthews, Wayne county, Ohio,—— 25
140. *Stove or fire-place.*—C. Hendrick and W. Elwell, Gardiner, Maine. 25

CELESTIAL PHENOMENA, FOR JUNE, 1836.

Calculated by S. C. Walker.

Day.	H'r.	Min.				
22	11	15	Im. *k'* Virginis,	,6,	N. 109	V. 157
22	12	0	Em.		195	245
28	14	47	Im. τ Sagittarii,	,4,	79	106
28	15	54	Em.		305	341

Meteorological Observations for February, 1836.

Moon.	Days	Therm. Sun rise.	Therm. 2 P.M.	Barometer. Sun rise.	Barometer. 2 P.M.	Wind. Direction.	Force.	Water fallen in rain.	State of the weather, and Remarks.
				Inches	Inches			Inches.	
☉	1	11°	19°	29.50	29.60	W.	Blustering		Clear day.
	2	1	9	.60	.84	SW.	do.		Clear—lightly cloudy.
	3	3	23	.90	.90	W.	Calm.		Clear—flurry of snow.
	4	3	11	.90	30.00	W.	do.		Clear day.
	5	3	9	30.10	.10	W.	Moderate.		Clear day.
	6	0	15	.10	.20	W.	do.		Clear day.
	7	16	31	.20	.15	E.	Calm.		Cloudy—snow.
	8	33	36	29.70	29.60	SW.	do.		Rain—cloudy.
☾	9	24	39	.63	.63	SW.	do.		Clear day.
	10	31	36	.90	30.00	W.	do.		Clear day.
	11	29	32	30.25	29.90	WNW.	do.		Clear—cloudy—snow in night.
	12	25	31	29.30	.25	E. SE.	do.		Snow—cloudy.
	13	30	36	.90	.85	SE. SW.	do.		Drizzle—cloudy.
	14	25	33	.75	.75	W.	Blustering		Cloudy—flurry of snow.
	15	10	29	.85	.55	SW.	Moderate.		Clear day.
	16	16	33	.90	.90	NW.	do.		Snow.
	17	16	21	30.20	30.26	SE.	do.		Clear day.
	18	4	24	.30	.34	N.	do.		Snow—lightly cloudy.
⊗	19	9	17	.34	.34	NE. N.	do.		Cloudy day.
	20	25	36	29.96	.94	E.	do.		Lightly cloudy.
	21	32	42	.94	.90	W.	do.		Clear day.
	22	33	46	.90	.90	W.	do.		Cloudy—hazy.
	23	34	46	.94	.90	NW. SE.	do.		Rainy day.
	24	37	43	.70	.54	SE.	do.		Flying clouds—clear.
	25	29	31	.70	.83	W.	Blustering		Snow.
	26	18	21	.96	.83	NE.	do.		Clear—lightly cloudy.
	27	13	27	30.10	30.30	W.	Moderate.		Clear—lightly cloudy.
	28	17	31	.35	.44	W.	do.		Cloudy day.
	29	18	29	.30	.30	E.	do.		
Mean		18.45	27.52	29.92	29.90				

	Thermometer.	Barometer.
Maximum height during the month,	46. on 22d and 23d.	30.44 on 28th.
Minimum do.	0. on 6th.	29.25 on 12th.
Mean do.	22.93	29.91